Instruction Manual · June 2008

million in one

# sitrans LUC500

SIEMENS

**Safety Guidelines:** Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

**Qualified Personnel:** This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

**Unit Repair and Excluded Liability:**

- The user is responsible for all changes and repairs made to the device by the user or the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

**Warning:** This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

**This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications.**

**Note:** Always use product in accordance with specifications.



**Contact SMPI Technical Publications at the following address:**
Technical Publications
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- For a selection of Siemens Milltronics level measurement manuals, go to: **www. siemens.com/processautomation**. Under Process Instrumentation, select *Level Measurement* and then go to the manual archive listed under the product family.
- For a selection of Siemens Milltronics weighing manuals, go to: **www. siemens.com/processautomation**. Under Weighing Technology, select *Continuous Weighing Systems* and then go to the manual archive listed under the product family.

# Table of Contents

# SITRANS LUC500



The SITRANS LUC500 is designed for use in advanced water and wastewater applications. This device can handle virtually all of your pump control and level monitoring needs – replacing expensive PLCs and integrating into a SCADA system.

The SITRANS LUC500 can be configured for nearly any water or wastewater application, control up to five pumps, gates, or alarms – and can communicate its status by way of direct serial connection, modem, or industrial communication network.

It can take discrete input from pumps or other devices to modify its operation, and can also time events to maximize efficiency or minimize cost.

Its basic features can be further enhanced with:

### Hardware Upgrades

- I/O Analog Cards
- RAM memory
- Discrete inputs

### Software Upgrades

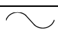
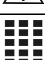
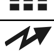
- Dual Point
- Data Logging

**Note:** The SITRANS LUC500 is to be used only in the manner outlined in this instruction manual or protection provided by the equipment may be impaired.

**Note:** This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications.

# Manual Symbols

Please note their use carefully.

| | |
|---|---|
|  | Alternating current |
|  | Direct current |
|  | Earth (ground) terminal |
|  | Protective conductor terminal |
|  | Caution (refer to instructions) |
|  | Program button on front of instrument |
|  | Infra-red communication port on front of instrument |
|  | RJ-11 communications port |
|  | No co-axial cable connections |

# Configuring SITRANS LUC500

The primary method of configuring the SITRANS LUC500 is using Siemens Milltronics **Dolphin Plus** software and a serial connection to the device.

Configuring the SITRANS LUC500 using the optional **Hand Programmer** is possible but is not recommended for complex installations.

As a rule of thumb, if your application falls into one of the pre-configured applications outlined in the SITRANS LUC500 instruction manual, then use the hand programmer. If your application is more complex, we suggest using Dolphin Plus. To purchase a copy of Dolphin Plus, contact your Siemens Milltronics representative.

# Power Interruptions

All operator programming is stored in non-volatile memory, and is unaffected by power interruptions. Reporting functions use volatile RAM with battery backup.

# Configuration Examples

The configuration examples used in this manual illustrate the versatility of the SITRANS LUC500. Because there is often a range of ways to approach an application, other configurations may also apply.

In all examples, substitute your own application details. If the examples do not apply to your application, check the applicable parameter reference for the available options.

Application guides are also available on our web site at **www.siemens.com/processautomation**.

If you require more information, please contact your Siemens Milltronics representative. For a complete list of Siemens Milltronics representatives, go to **www.siemens.com/processautomation**.

# Specifications

**Note:** Siemens Milltronics makes every attempt to ensure the accuracy of these specifications but reserves the right to change them at any time. Please ensure these are the most recent specifications. Contact your representative, or check our web site at www.siemens.com/processautomation for the most up-to-date information.

## Power

- AC version: 100-230 Vac ± 15%, 50 / 60 Hz, 36 VA (17W)[1]
  fuse: F3: 2 AG, Slow Blow, 0.375A, 250V
- DC version: 12-30 Vdc, 20W[1]
  fuse: F3: 2 AG, Slow Blow, 3A, 250V
- Transmitter fuse: F1: Belling Lee, L754, 4000A HRC, ceramic type, 100mA, 250V
- Temperature Sensor fuse: F2: Belling Lee, L754, 4000A HRC, ceramic type, 50mA, 250V

## Environmental - Rack or Panel Mount

- Location: indoor
- Altitude: 2000 m max.
- Ambient temperature: -20 to +50 °C (-5 to +122 °F)
- Relative humidity: 80% for temperatures up to +50 °C (+122 °F)
- Installation category: II
- Pollution degree: 2

## Environmental - Wall Mount

- Location: indoor / outdoor
- Altitude: 2000 m max.
- Ambient temperature: -20 to +50 °C (-5 to +122 °F)
- Relative humidity: suitable for outdoors
- Installation category: II
- Pollution degree: 4

## Range:

- 0.3 m (1 ft) to 15 m (50 ft) dependent on transducer

## Accuracy:

- 0.25% of maximum range or 6 mm (0.24”) whichever is greater

## Resolution:

- 0.1% of program range[2] or 2 mm (0.08”), whichever is greater

1. Power consumption is listed at maximum. The power consumption is considerably lower if no load is placed on the SITRANS LUC500’s 24V rails which are used to power discrete interlocks on passive devices.

## Memory:

- 1024 KB static RAM with battery backup
- 1MB flash EPROM

## Programming

- Primary: PC running Dolphin Plus software
- Secondary: handheld programmer

## Display

- back-lit LCD

## Synchronization

- up to 16 SITRANS LUC500 units can be synchronized together

## Temperature Compensation

- Range: -50 to +150 °C (-58 to +302 °F)
- Source: integral transducer sensor, TS-3 temperature sensor, programmable fixed temperature

## Temperature Error

- Sensor: 0.09% of range
- Fixed: 0.17% per °C deviation from programmed value

## Outputs

- 24 Vdc power: 24V ± 20%, 45 mA max. (no short circuit protection)
- Transducer drive: 315 V peak, 44 KHz
- Relays[1]: 4 control / 1 alarm relay
  all relays rated 5 A at 250 V ac, non-inductive
- Control Relays: 4 Form **A**, NO relays (number 1-4)
- Alarm Relay
  - Rack or panel mount: 1 Form **B**, NC relay (number 5)
  - Wall mount: 1 Form **C**, NO or NC relay (number 5)
- mA output (optional, only available with aux. I/O cards):
  0/4 to 20 mA, 750 ohm max. loading, 0.1% linearity, isolated
- Communication: RS-232 running Siemens Milltronics Dolphin protocol
  RS-232 running Modbus RTU and ASCII
- Optional: SmartLinx® compatible
  RS-485 (available with auxiliary I/O cards)

## Inputs

- mA (analog) (1): 0 to 20 or 4 to 20 mA, from alternate device, scaleable

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2. Program range is defined as the empty distance from the face of the transducer (P006) plus any range extension (P801).

1. All relays are certified only for use with equipment that fails in a state at or under the rated maximums of the relays.

- Discrete (8): 10 to 50 V dc switching level
  logical 0 = < 0.5 V dc
  logical 1 = 10 to 50 V dc
  3 mA max. draw
- Frequency (2)[1]: 1-20,000 Hz
- Counter (2)[1]: 5 msec minimum pulse width

## Enclosure

- Rack mount: DIN 3U/21HP, 4 rail plug in unit
  suitable for standard 3U/84HP (19") sub rack
- Panel mount: suitable for DIN 43700 72 x 144 standard panel cut-out on 110 mm (4.33") centres
- Wall mount: 224 mm W x 285 mm H x 102 mm D (8.8" W x 11.2" H x 4.0" D)
  Type 4X / NEMA 4X / IP 65, Polycarbonate

## Weight

- Rack or Panel mount: 1.5 kg (3.3 lbs)
- Wall mount: 2.5 kg (5.5 lbs)

## Approvals

- See product nameplate

## Compatible Transducers

- Echomax® series and ST-H series

## Transducers

- Base Model: single point, second transducer can only be used for average, differential, or sum
- Option: dual point (44 kHz)
- Cable:
  - Do not use coaxial cable for transducers
  - 2 copper conductors, twisted with a shield/drain wire, 300V 0.5 mm$^2$ (22-18AWG), nominal capacitance between adjacent conductors @ 1kHz=62.3 pF/m (19 pF/ft.), nominal capacitance between conductor and shield @ 1kHz=108.3 pF/m (33 pF/ft.) (Belden 8760[2]is acceptable).
  - 365 m (1200 ft) maximum

**Note:** The SITRANS LUC500 is to be used only in the manner outlined in this instruction manual or protection provided by the equipment may be impaired.

1. Discrete inputs 7 and 8 can be configured as frequency inputs, pulse counters, or simple discrete inputs.
2. Belden® is a registered trademark of Belden Wire and Cable Company.

Specifications

# Installation

**Notes:**

- Installation must only be performed by qualified personnel, and in accordance with local governing regulations.
- This product is susceptible to electrostatic shock. Follow proper grounding procedures.

⚠ **All field wiring must have insulation suitable for at least 250V.**

⚠ **Hazardous voltages present on transducer terminals during operation.**

⚠ **DC input terminals shall be supplied from a source providing electrical isolation between the input and output, in order to meet applicable safety requirements of IEC 61010-1.**

- Relay contact terminals are for use with equipment that has no accessible live parts and wiring that has insulation suitable for at least 250 V. The maximum allowable working voltage between adjacent relay contacts shall be 250 V.
- The non-metallic enclosure does not provide grounding between conduit connections. Use grounding type bushings and jumpers.

# Mounting Location

### Recommended

- Ambient temperature is always within -20 to +50 °C (-5 to +122 °F)
- SITRANS LUC500 display window is at eye level, unless most interaction is through a SCADA system
- Easy access for hand programmer is provided (see next page)
- Cable length requirements are minimal
- Mounting surface is free from vibration
- A place for a laptop computer is provided on-site for Dolphin Plus configuration (See below regarding laptop access.)

### Avoid

- Exposure to direct sunlight. (Provide a sun shield to avoid direct sunlight.)
- Proximity to high voltage/current runs, contacts, SCR or variable frequency motor speed controllers

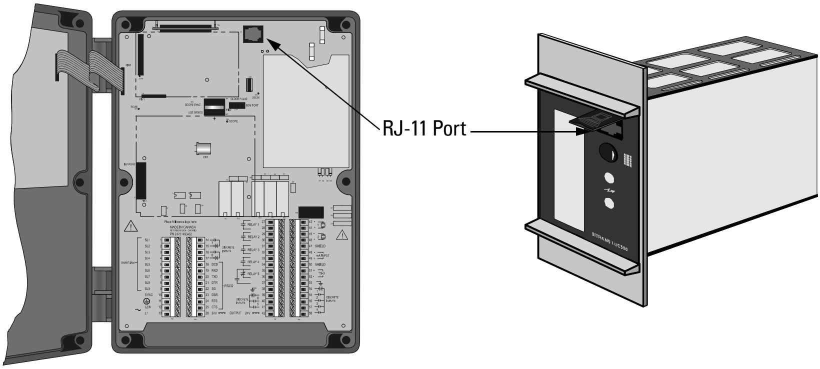


# Laptop Access

### RS-232 Connections

Use the laptop for configuration and diagnosis by linking to the SITRANS LUC500's RJ-11 port via an RS-232 connection.

The RJ-11 port is located inside the enclosure of the wall mount version, and on the face of the rack and panel units.



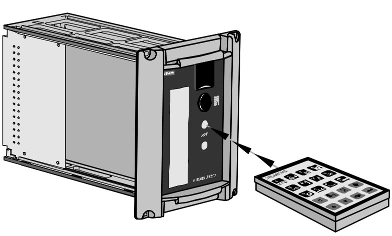

In addition, all SITRANS LUC500 units have RS-232 connections on the terminal board so they can be permanently wired to modems for remote access, or telephone jacks for easy local access. See *Optional Card Wiring* on page 25 to wire a permanent communications connection to the SITRANS LUC500 terminal board.

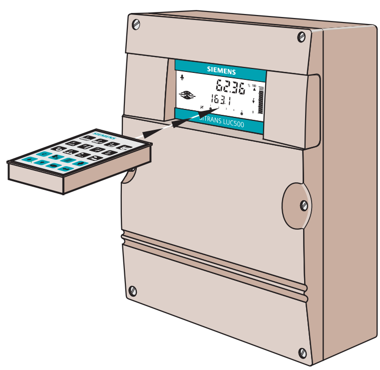
### RS-485 Connections

RS-485 ports are available on optional I/O cards. See *Optional Card Wiring* on page 25 for wiring of the RS-485.

## Hand Programmer Access

The hand held programmer is aimed at the receiver as shown below.





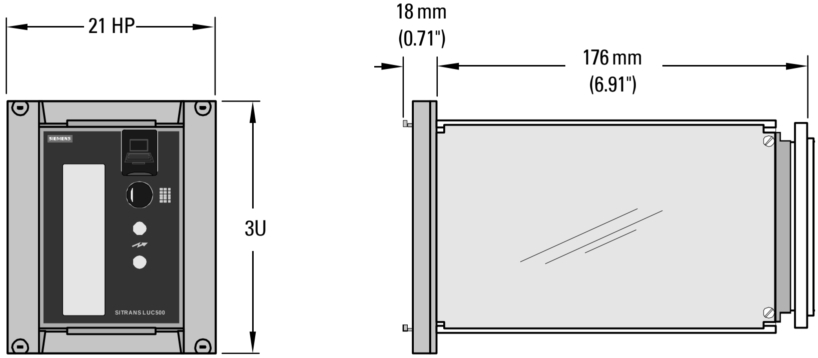
If values from the hand programmer are not accepted and display does not respond, try repositioning it. For the rack and panel mounted versions, ensure the unit is in program mode by pressing .

# Mounting Instructions

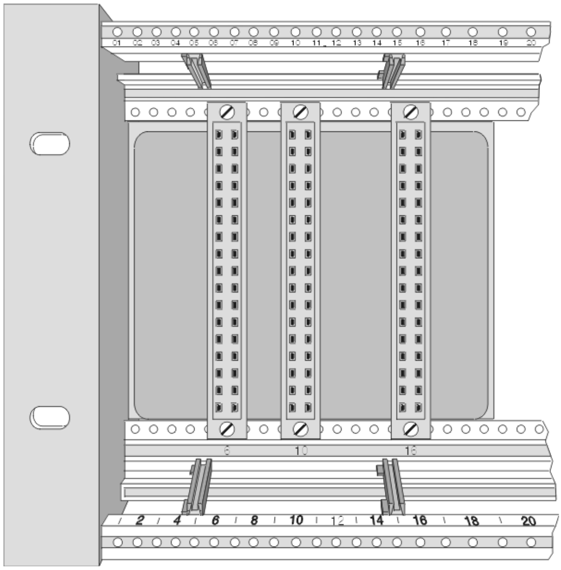
**Notes:**

- Rack and rails are supplied by the customer.
- Terminal board screws are supplied by the customer.
- Metallic racks must be grounded.

## Rack Mount




1. Install rails at positions 5 and 15 as in diagram below.

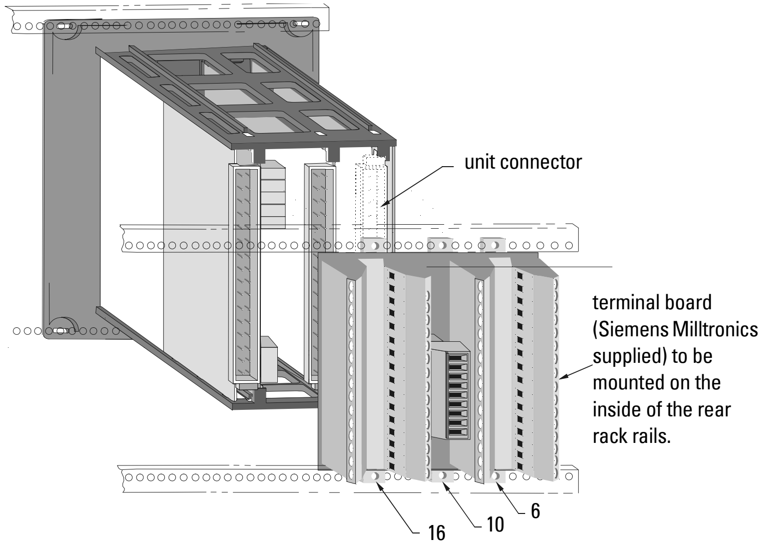


**Note:** Positions are in relation to left end of rack. Adjust measurements accordingly if the unit is to be installed elsewhere along the rails.

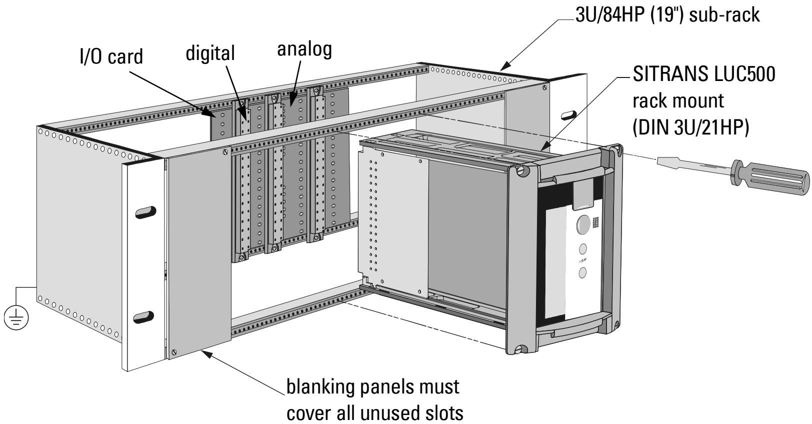
2. Test the fit of the SITRANS LUC500 to ensure the rails are aligned correctly by sliding the SITRANS LUC500 unit in and then out again.

Installation

3. Mount the terminal board **on the inside rails of the rack**, with mounting screws at positions 6, 10, and 16.



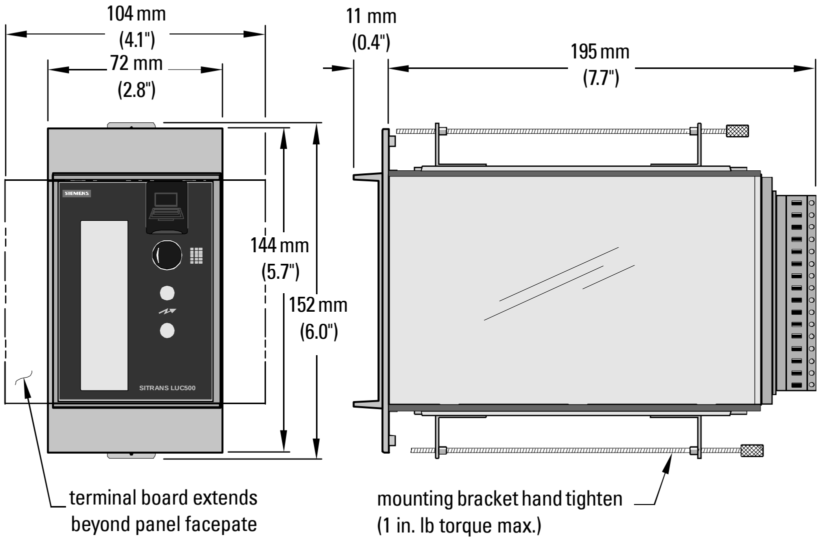

4. Slide the SITRANS LUC500 into the rack and press fit it with the rail mounted terminal board.




5. Tighten the four mounting screws on the faceplate.
6. Wire the unit from the back according to the Rack or Panel Mount wiring diagrams on page 20.

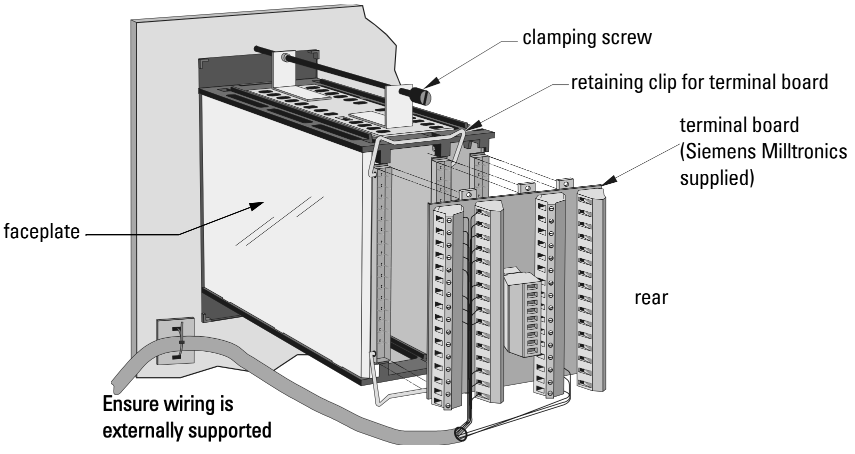
Installation

# Panel Mount



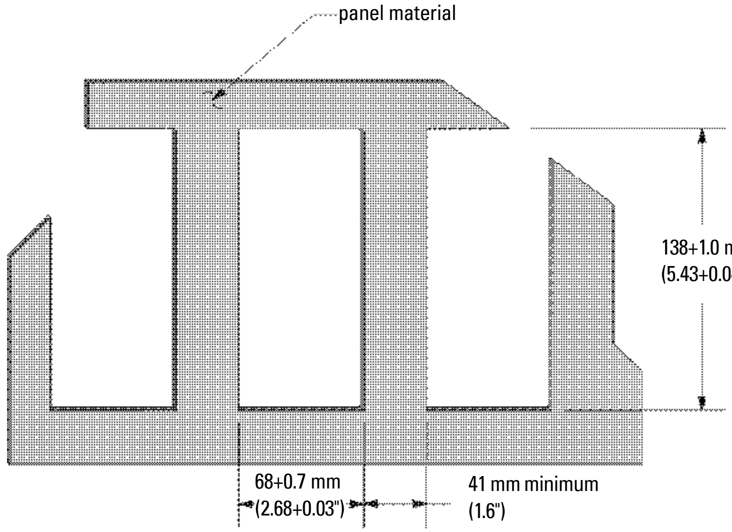

**Note:** Cut-out dimension for Panel Mounting should be 68 + 0.7 mm x 138 + 1.0 mm (2.68 + 0.03" x 5.43 + 0.04").

1. Unlatch the retaining clips and remove the terminal board from the unit.

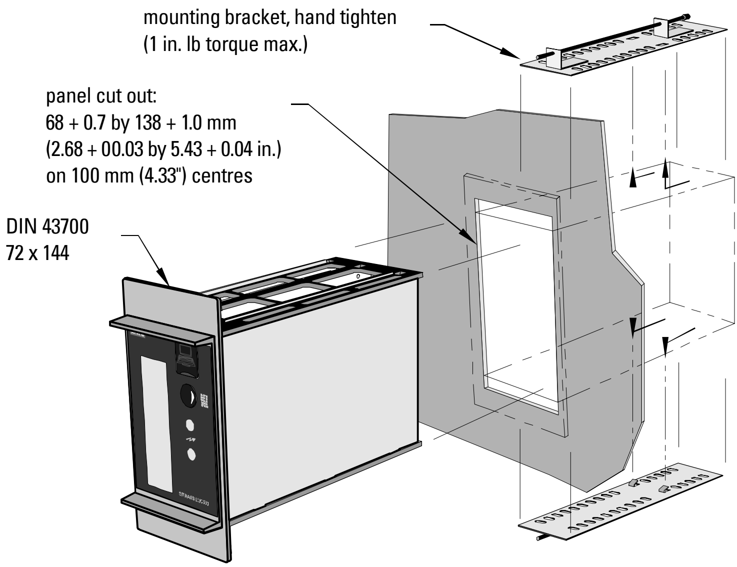



Installation

2. Slide the SITRANS LUC500 through the panel cut-out.

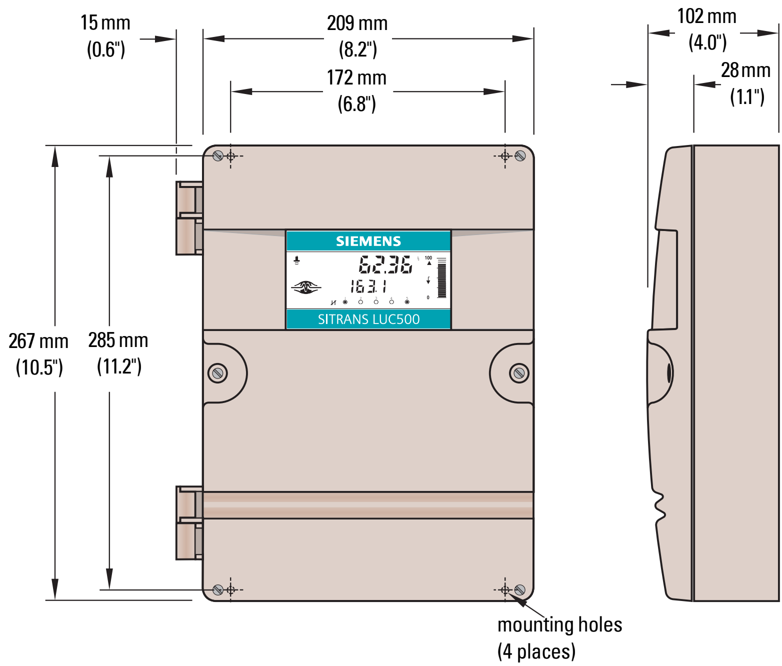



3. Assemble mounting brackets to the SITRANS LUC500 chassis by hooking them into the top and bottom (bottom first).
4. Tighten the mounting bracket clamping screw (top & bottom).

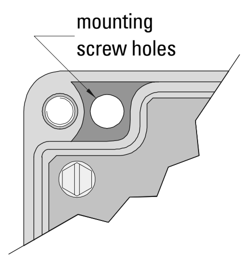



5. Wire terminal board according to the Rack or Panel Mount wiring diagrams on page 20.
6. Press fit the terminal board to the SITRANS LUC500. Provide external support for the wires to ensure that the pressure on the rear of the unit is minimized.

# Wall Mount




## Mounting the Enclosure




1. Remove the lid screws and open the lid to reveal the mounting screw holes.
2. Mark and drill four holes in the mounting surface for the four screws (customer supplied).
3. Fasten with a long screw driver.

## Please note:

- Recommended mounting: directly to wall or electrical cabinet back panel
- Recommended mounting screws: #6
- If alternate mounting surface is used, it MUST be able to support four times the weight of the unit.

## Cable routed through a conduit:

1. Unplug the display ribbon cable from the motherboard.
2. Remove the four mounting screws holding the motherboard to the enclosure.
3. Pick up the motherboard from the right side (opposite the ribbon cable) and pull the board out of the enclosure half way. Be careful not to damage the electronics with static electricity.
4. Detach the ribbon cable and remove the motherboard from enclosure.
5. Drill any required cable entry holes.
6. Attach the conduit to the enclosure using approved Conduit Entrance Hubs.
7. Reinstall the motherboard with the mounting screws and attach ribbon cable.

**Cable exposed and enters through the customer supplied cable glands:**

1. Unscrew the glands and attach them loosely to the enclosure.
2. Thread the cables through the glands; ensure the power cable is kept separated from the signal cables.
3. Wire the cables to the terminal blocks.
4. Tighten the glands to form a good seal.
5. If you require more holes than are supplied in the enclosure, follow the previous steps under conduit.

# Installing the Battery

The battery (Rayovac BR2032) has a life expectancy of ten years, and is affected by ambient temperature. If the unit loses external and battery power, a capacitor will power the RAM for about 10 minutes.

The flash memory is updated every hour. Therefore, up to an hour of data logging can be lost if all of the following conditions happen:

- the external power fails
- the battery is not supplying power
- the time it takes to restore power to the SITRANS LUC500 is greater than the time the capacitor can supply power.

**Notes:**

- Do not install the memory backup battery until the SITRANS LUC500 is installed as it begins operation immediately.
- The unit is supplied with one battery. Insert the battery into the holder as shown in the following diagrams before using the SITRANS LUC500.

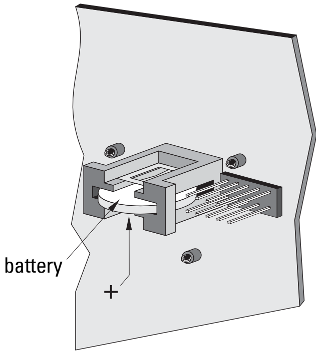
**WARNING:**

⚠ **Disconnect power before installing or replacing the battery.**

Installation

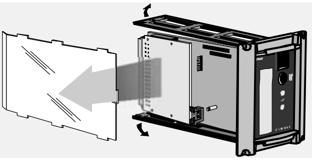
## Wall Mount

1. Open the enclosure lid.
2. Slide the battery into the holder being careful to align the + and – terminals (sides) correctly.
3. Close and secure the enclosure lid.

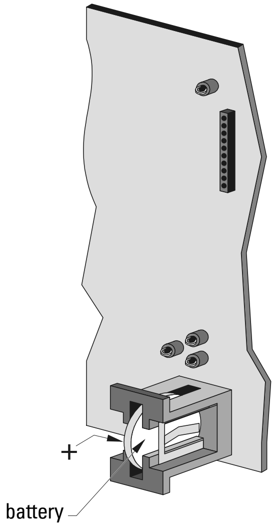



## Rack or Panel Mount

1. Remove the plastic side shield.



2. Slide the battery into the holder being careful to align the + and – terminals (sides) correctly.
3. Replace the plastic side shield.



# Installing Optional Cards

The following optional cards can be ordered from Siemens Milltronics:

### SmartLinx module

Used to enhance the existing SITRANS LUC500 Communications System.

### Expansion Memory Card

Used in conjunction with the SITRANS LUC500's Optional Data Logging Feature.

### Analog Input / Output cards:

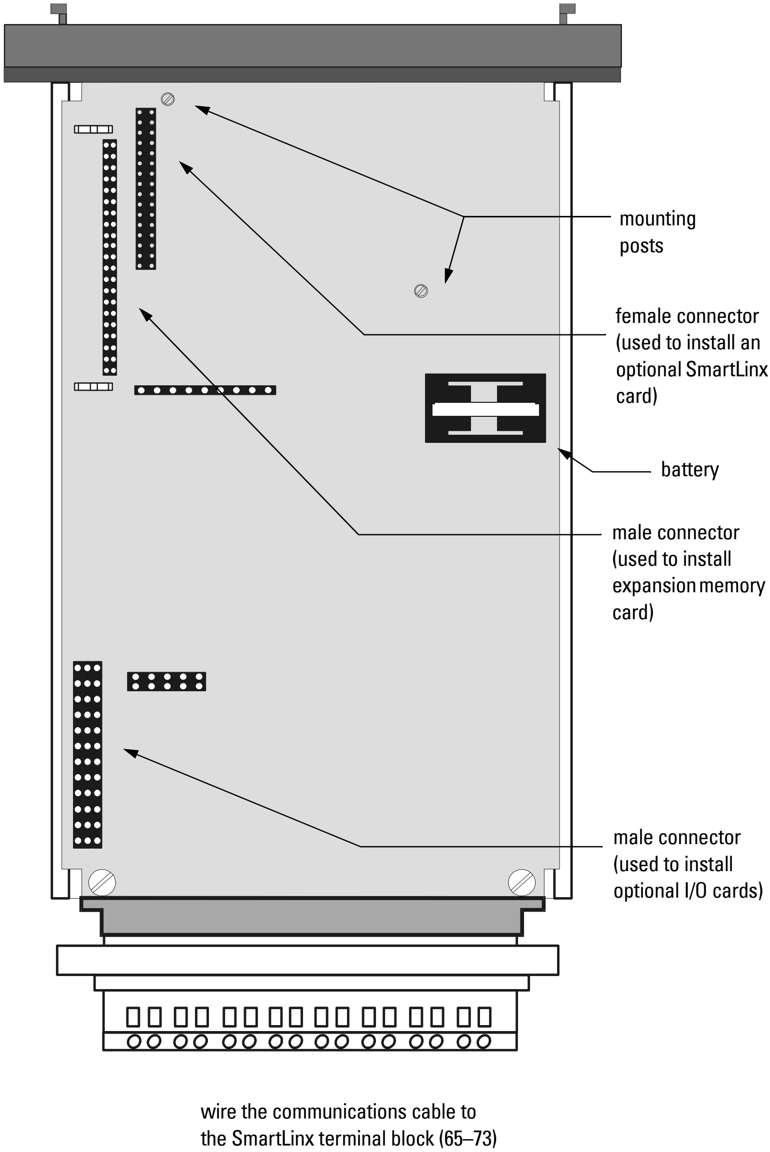
- mA Output Card
  This card has 4 mA Outputs.
- mA Input /Output Card
  This card has 2 mA inputs, and 2 mA outputs.
- mA Input card
  This card has 4 mA Inputs.
- Discrete Input card
  This card has 8 discrete inputs.
- Discrete Input, mA Input / Output Card (Wall Mount unit only)
  This card has 8 discrete inputs, 2 mA inputs, and 2 mA outputs.

**WARNING:**

⚠ **Before installing cards, ensure that power is off.**

Installation

# Installing Optional Cards in Rack or Panel Units

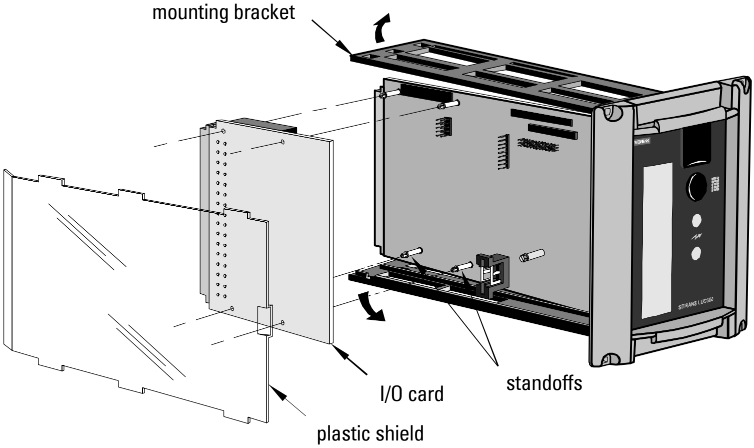



## SmartLinx Modules

1. Align SmartLinx card with the two mounting posts, and press-fit with the female connector.
2. Use the screws supplied with the SmartLinx module to attach it to the mounting posts.
3. Wire the SmartLinx card in according to SmartLinx instruction manual.

## Analog Input /Output Cards

1. Remove the plastic shield.
2. Pry the top and bottom mounting brackets away from the unit as shown below.



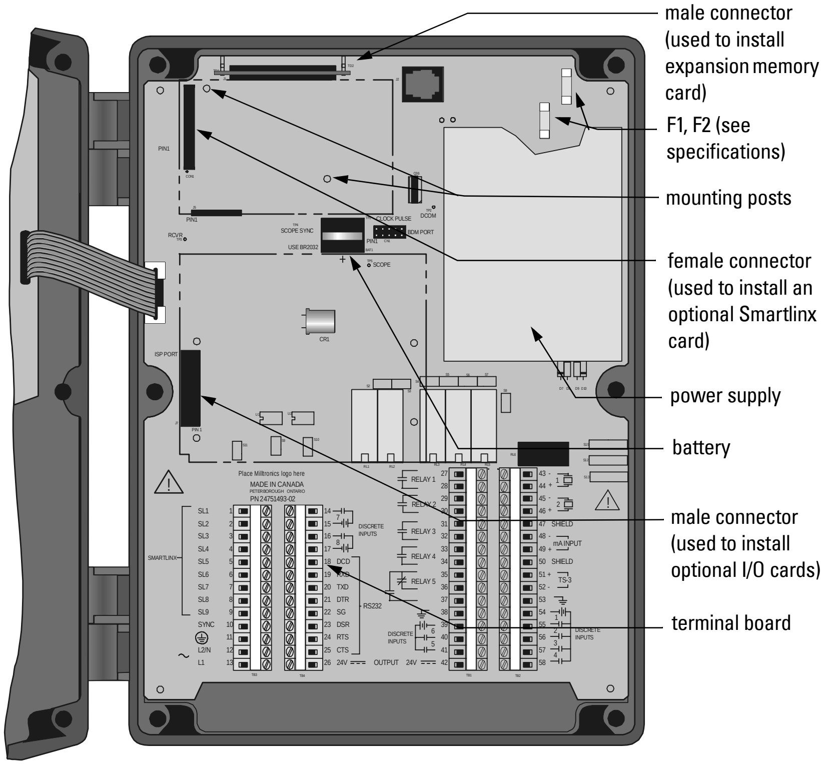

3. Align the I/O card with the 36 pin male connector and the four standoffs.
4. Press fit the I/O card until it snaps into place.
5. Replace the mounting brackets and the plastic shield.
6. Slide the SITRANS LUC500 back into place.
7. Wire the cards as shown in *Optional Card Wiring* on page 25.

## Expansion Memory

1. Align the optional Expansion Memory to the male connector.
2. Push-fit the Expansion Memory Card into place.

Installation

# Installing Optional Cards in Wall Mount Units




## SmartLinx Module

1. Align card with the 2 mounting posts, and press-fit with the female connector.
2. Use the screws supplied with the card to attach it to the mounting posts.
3. Wire the SmartLinx card in according to SmartLinx instruction manual.

## Analog Input /Output Cards

1. Align the I/O card with the 36 pin male connector and the four standoffs.
2. Use the screws supplied with the card to attach it to the mounting posts.
3. Wire the I/O Card as shown in *Optional Card Wiring* on page 25.

## Expansion Memory

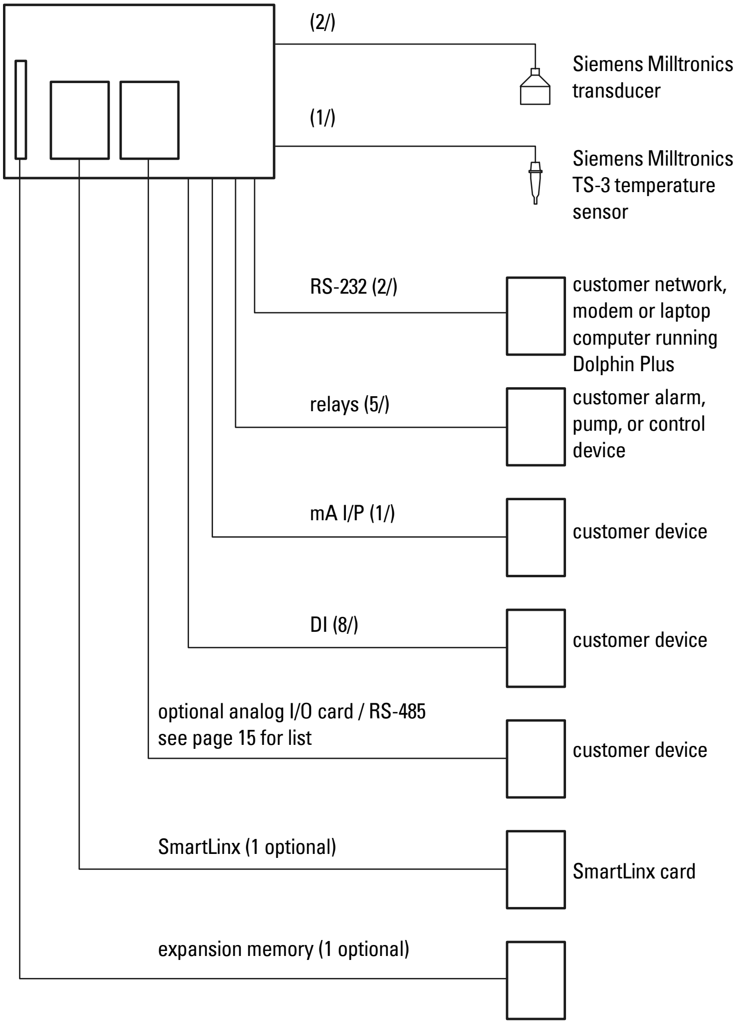
1. Align the optional Expansion Memory to the male connector.
2. Push-fit the Expansion Memory Card into place.

# Wiring

**Please note:**

- Verify all system components are installed in accordance with instructions.
- Connect all cable shields to the SITRANS LUC500 shield connections. Avoid differential ground potentials by not connecting cable shields to ground (earth) anywhere.
- Keep exposed conductors on shielded cables as short as possible to reduce noise on the line caused by stray transmission and noise pickup.

## System Diagram



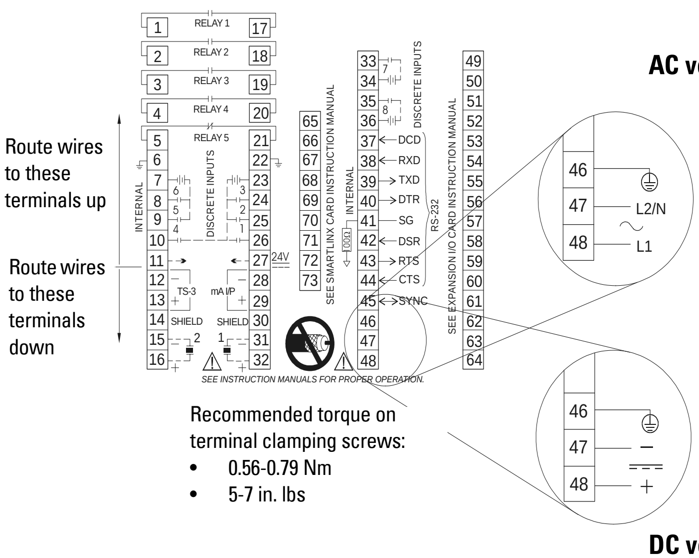

Wiring

# Terminal Board

The terminal board on the SITRANS LUC500 allows all inputs and outputs to be connected simultaneously.

# Rack or Panel Mount

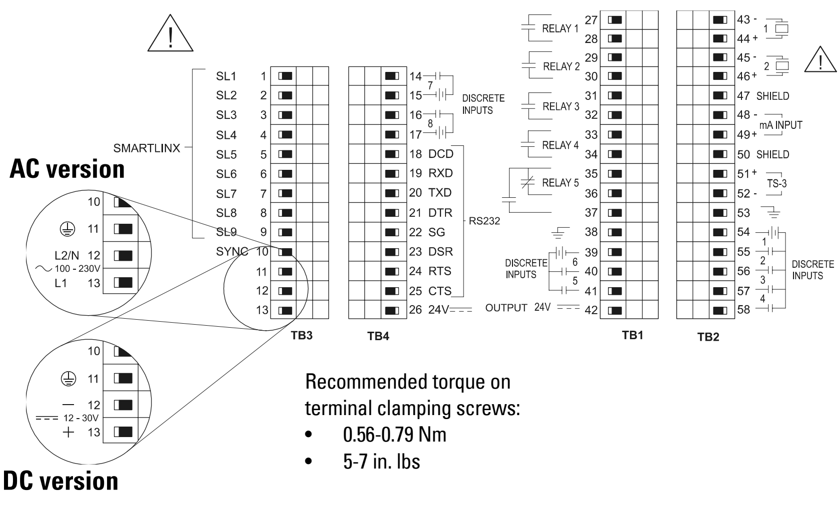
This diagram is found on the side shield of the SITRANS LUC500.




Recommended torque on terminal clamping screws:

- 0.56-0.79 Nm
- 5-7 in. lbs

# Wall Mount




Recommended torque on terminal clamping screws:

- 0.56-0.79 Nm
- 5-7 in. lbs

Wiring

# Cables

The SITRANS LUC500 transceiver requires a shielded two-wire connection to the transducer.

| Connection | Cable Type |
| --- | --- |
| mA input, sync, temperature sensor, discrete input, DC input, transducer | 2 copper conductors, twisted, with a shield/drain wire, 300V 0.5-0.75 mm$^2$ (22 - 18 AWG) |
|  | Do not use a coaxial transducer cable extension with the SITRANS LUC500 because of electrical noise. |
| Relay output<br>AC input | Relay to be copper conductors per local requirements to meet 250V 5A contact rating. |

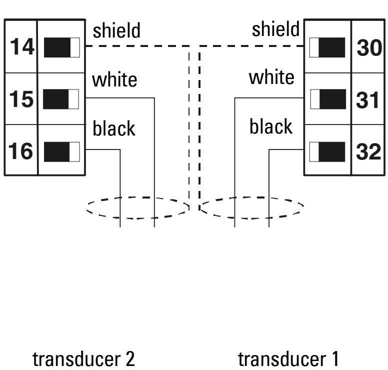
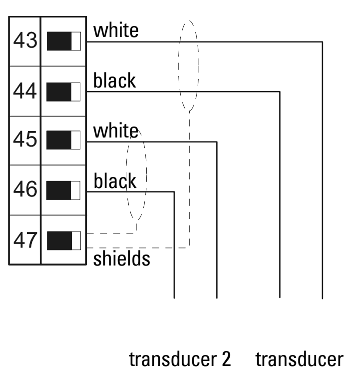
# Transducers

**WARNING:**

**⚠ Hazardous voltage present on transducer terminals during operation.**
**Run the transducer cable in a grounded metal conduit, separate from other wiring, (except TS-3 temperature sensor wiring, if applicable).**

**Notes:**

- Do not use coaxial cable because of electrical noise.
- Do not connect the shield and white transducer wires together.
- Disregard older transducer manuals that recommend these practices.

| Rack or Panel Mount | Wall Mount |
| --- | --- |
|  |  |

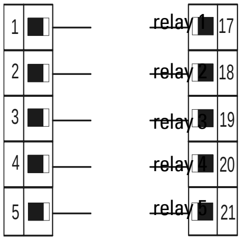
# Relays

Relay contacts are shown in the de-energized position. In the software used in SITRANS LUC500, all relays are handled identically and can be configured as positive or negative logic using P118.

### Rack or Panel Mount

**Relay ratings:**

- 4 Form **A**, NO relays (1-4)
- 1 Form **B**, NC relay (5)
- 5 A at 250 V ac, non-inductive




**Power Failure**

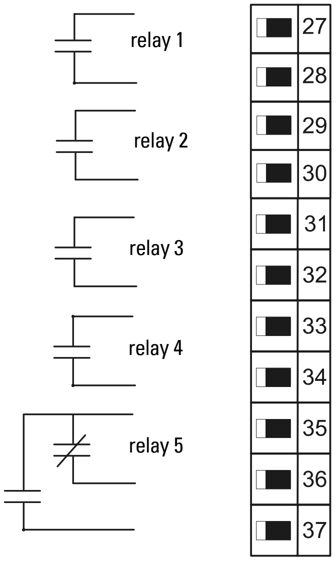
Relays 1 to 4 are normally open and will fail in the open state.

Relay 5 is normally closed and will fail in the closed state.

### Wall Mount

**Relay ratings:**

- 4 Form **A**, NO relays (1-4)
- 1 Form **C**, NO or NC relay (5)
- 5 A at 250 V ac, non-inductive




**Power Failure**

Relays 1 to 4 are normally open and will fail in the open state.

Relay 5 can be wired either normally open or normally closed and will fail in its de-energized state.

Wiring

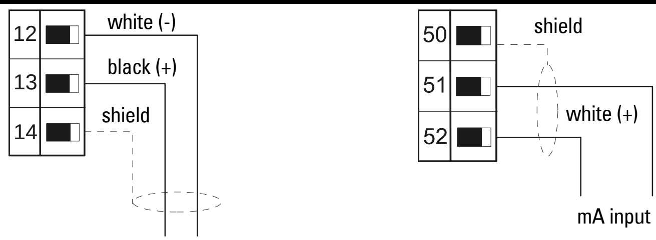
# Temperature Sensor

All Siemens Milltronics Echomax and ST-H transducers have an internal temperature sensor. For optimum accuracy, use a separate TS-3 temperature sensor if:

- the transducer is exposed to direct sunlight (or other radiant heat source)
- the transducer face and monitored surface temperature differs
- faster response to temperature changes is required.

Accurate temperature readings are critical to accurate level measurements because the speed of sound changes as a function of the air temperature.

**Rack or Panel Mount** | **Wall Mount**

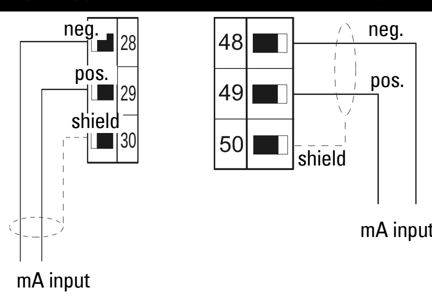



Use a TS-3 temperature sensor only. Do not jumper unused TS-3 terminals.

# mA Input

For more information on this feature consult the Transducer (P004) and mA Input Parameters (P250, P251, and P252) in *Parameter Reference* on page 171.

**Rack or Panel Mount** | **Wall Mount**



# Level System Synchronization

When multiple ultrasonic level monitors are to be used, ensure the transducer cable(s) are run in separate grounded metal conduits. Otherwise, synchronize the level monitors so that no unit can transmit while another is waiting for echo reception.

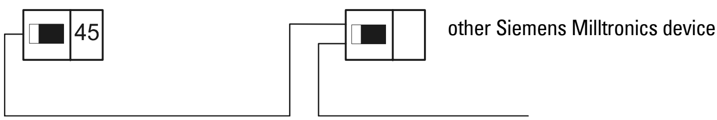
**To synchronize with another SITRANS LUC500, or other Siemens Milltronics instruments:**

- Mount the level monitors together in one cabinet
- Use a common power (mains) supply and ground (earth) for all units
- Interconnect the SYNC terminals of all level monitors
- Ensure parameter for Level System Sync (P726) is enabled.

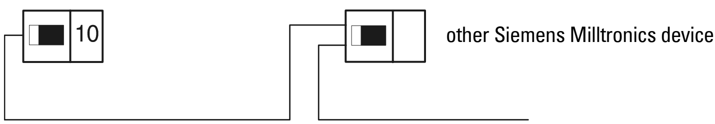
**To synchronize with other Siemens Milltronics ultrasonic level monitors:**

- contact Siemens Milltronics or your local distributor.

**Rack or Panel Mount**




**Wall Mount**

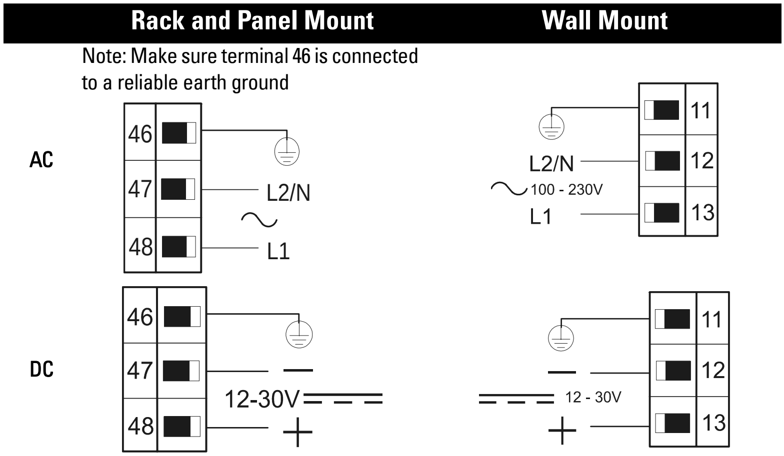



# Power

**IMPORTANT!**
Before applying power to the SITRANS LUC500 for the first time, ensure any connected alarm/control equipment is disabled until satisfactory system operation and performance is verified.

**Notes for AC Power connections:**

- The equipment must be protected by a 15A fuse or circuit breaker in the building installation.
- A circuit breaker or switch in the building installation, marked as the disconnect switch, must be in close proximity to the equipment and within easy reach of the operator.




# Optional Card Wiring

| Wall mount | Rack & Panel | mA I/P 4AI | mA O/P 4AO | mA I/O 2AI/2AO | Discrete I/P 8 per card | 8 Discrete I/P, 2 AI/2AO |
|---|---|---|---|---|---|---|
| 101 | 49 | B | B | B | B | |
| 102 | 50 | A | A | A | A | |
| 103 | 51 | COM | COM | COM | COM | |
| 104 | 52 | B | B | B | B | |
| 105 | 53 | A | A | A | A | |
| 106 | 54 | SPARE | SPARE | SPARE | COM 9-12 | Available only with Wall mount unit. See page 28 for Wiring |
| 107 | 55 | SHLD | SHLD | SHLD | 9+ | |
| 108 | 56 | IN 2- | OUT 1- | OUT 1- | 10+ | |
| 109 | 57 | IN 2+ | OUT 1+ | OUT 1+ | 11+ | |
| 110 | 58 | IN 3- | OUT 2- | OUT 2- | 12+ | |
| 111 | 59 | IN 3+ | OUT 2+ | OUT 2+ | SPARE | |
| 112 | 60 | SHLD | SHLD | SHLD | COM 13-16 | |
| 113 | 61 | IN 4- | OUT 3- | IN 2- | 13+ | |
| 114 | 62 | IN 4+ | OUT 3+ | IN 2+ | 14+ | |
| 115 | 63 | IN 5- | OUT 4- | IN 3- | 15+ | |
| 116 | 64 | IN5+ | OUT 4+ | IN 3+ | 16+ | |

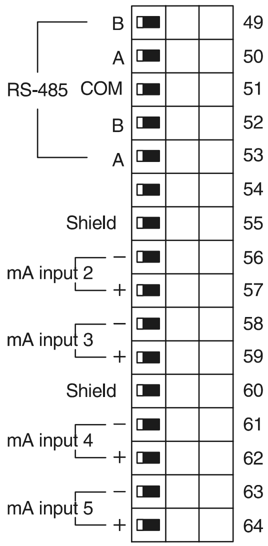
### For Wall Mount wiring…

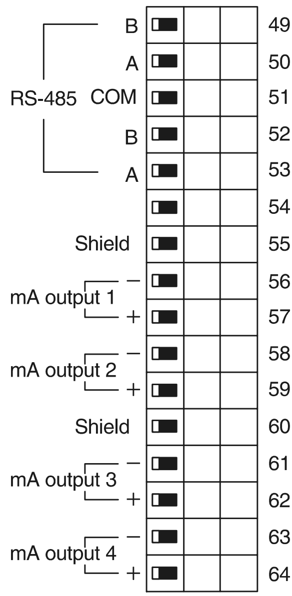
The values in this table refer to the Terminal Block on the plug-in card.

# Rack and Panel Mount

## Input or Output Option Cards (Rack or Panel Mount)

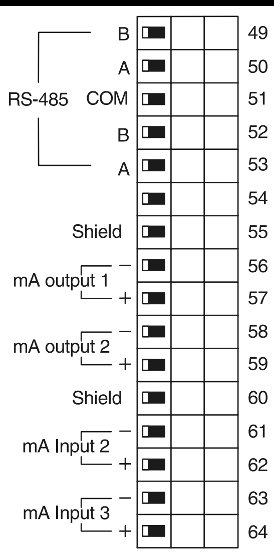
| 4 mA Inputs | 4 mA Outputs |
|---|---|




## Input and Output Option Card (Rack or Panel Mount)

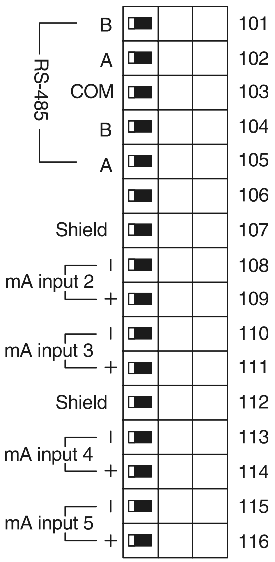
| 2 mA Inputs / 2 mA Outputs |
|---|

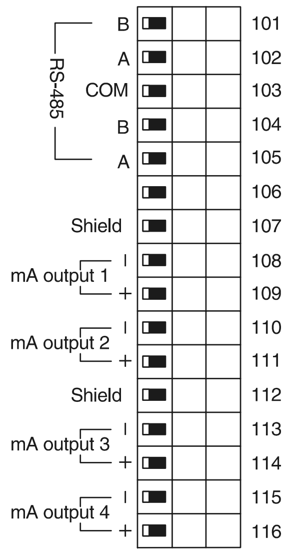


# Wall Mount

## Input or Output Option Cards (Wall Mount)

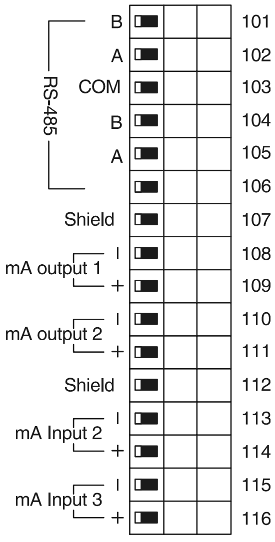
| 4 mA Input | 4 mA Output<br>Powered by the SITRANS LUC500 |
|---|---|



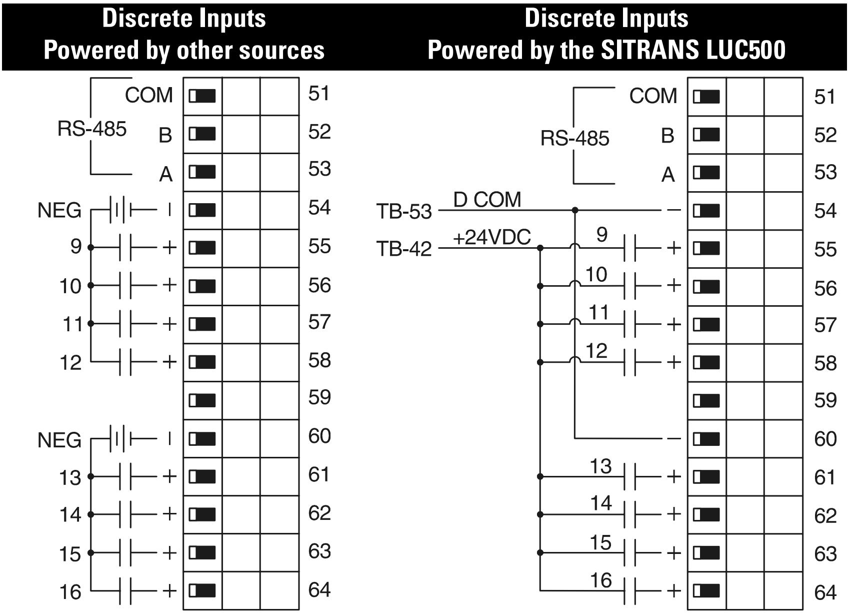




## Input and Output Option Card (Wall mount)

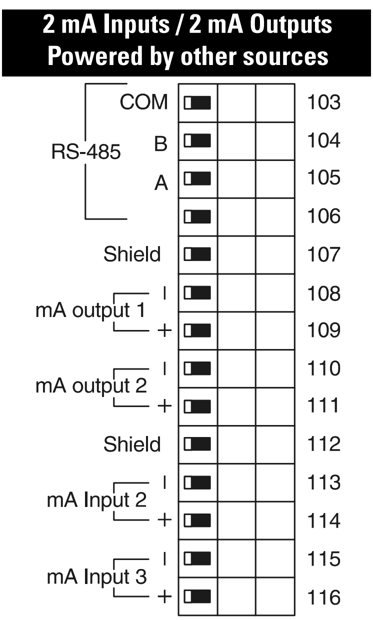
| 2 mA Inputs / 2 mA Outputs<br>Powered by other sources |
|---|



## Discrete Input, mA Input /Output Option Card (Wall mount)




* TB2 located on motherboard



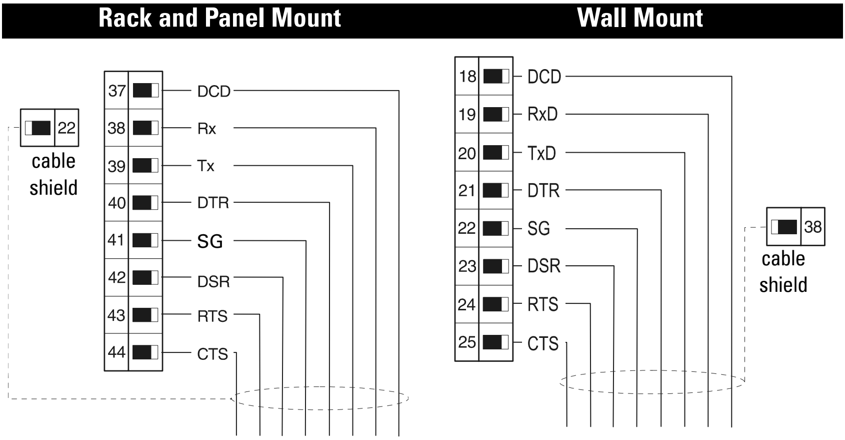

Wiring

# Digital Communications

Wiring the SITRANS LUC500 for communications allows it to be integrated into a full SCADA system or an industrial LAN.

SITRANS LUC500 can also be directly connected to a computer running Dolphin Plus.

## RS-232 Serial Connection




Do not ground cable shield to signal ground (SG).
Instead, ground the cable shield.

When wiring serial communications to a Dolphin Plus Unit, you need to only connect the Rx, Tx and signal ground lines. See the Dolphin Plus instruction manual for more detailed wiring information.

See the SITRANS LUC500 Communications section for more details on wiring for Modbus-based SCADA systems.

## Discrete Inputs

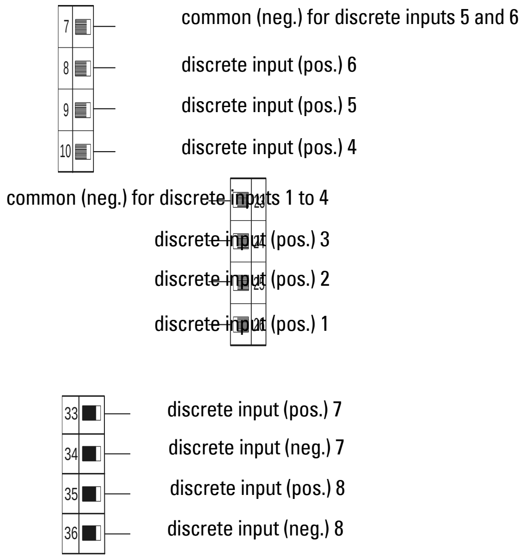
Discrete inputs are used to trigger or alter the way SITRANS LUC500 controls devices such as pumps and alarms. These inputs accept a DC signal between 10 and 50 V as the discrete input is triggered by an external device such as a pump, float, or other alarm.

These external devices are either self-powered or passive. The self-powered device supplies its own DC voltage. The passive device uses power supplied by the SITRANS LUC500.

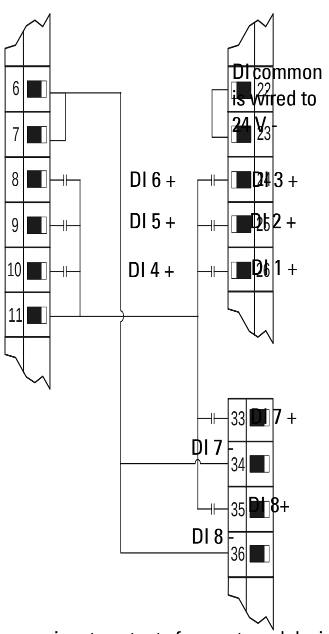
# Rack and Panel Mount

Discrete inputs have a positive and negative terminal.

## Rack Mount Powered by External Device




## Wiring Example – Powered by SITRANS LUC500

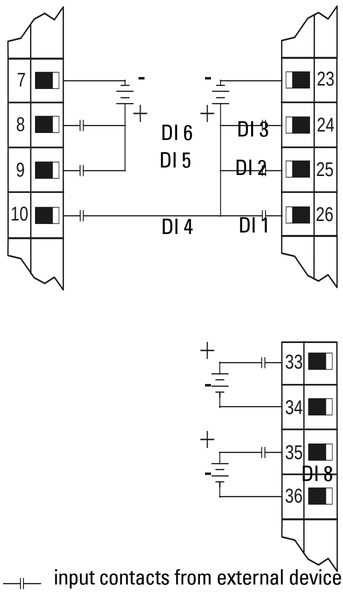



—||— input contacts from external device

**Example Wiring**

This is an example of all eight discrete inputs wired using the 24 VDC rails on the SITRANS LUC500. Use this wiring model if your external device does not provide power to the discrete inputs.

## Wiring Example – Powered by External Source

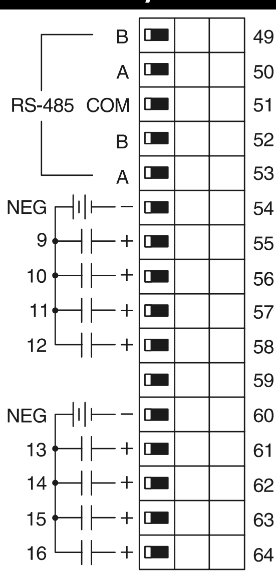


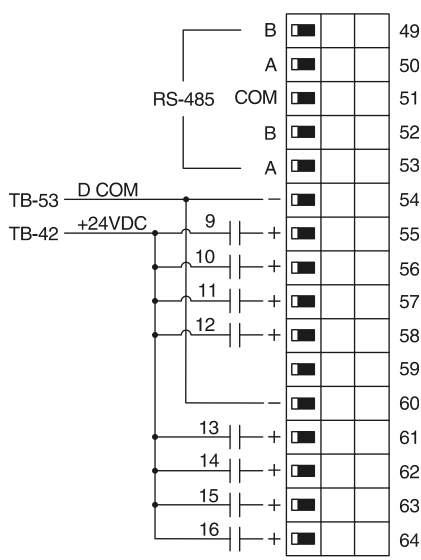

**Example Wiring**

This is an example of all eight discrete inputs wired using power supplied from an external source.
Use this wiring model if your external device provides its own power to the discrete inputs.

## Discrete Input (DI) Option Cards (Rack or Panel Mount)

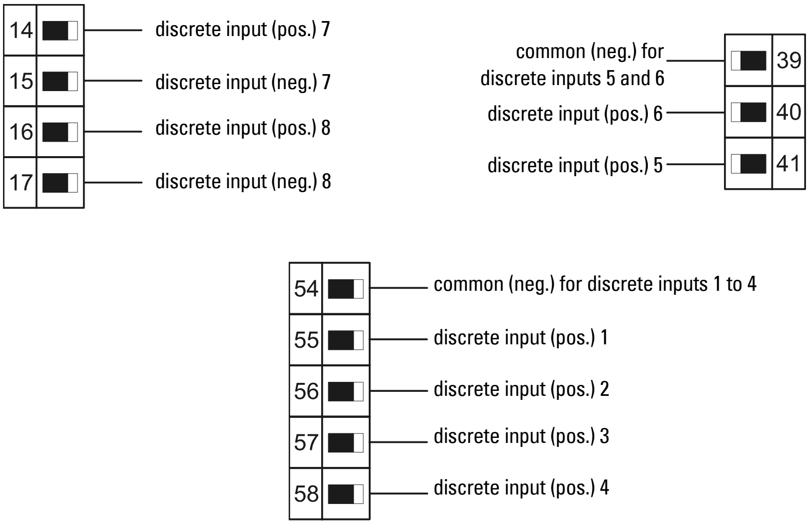
| **Powered by other sources** | **Powered by the SITRANS LUC500** |
|---|---|



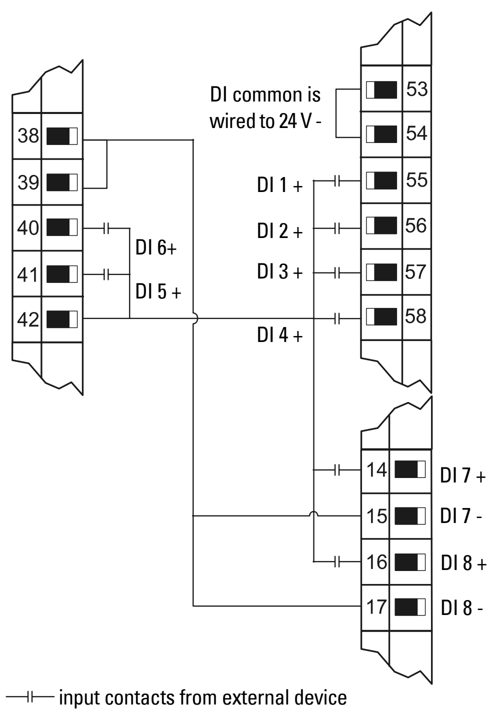



# Wall Mount

Discrete inputs have a positive and negative terminal.




### Wiring Example – Powered by SITRANS LUC500

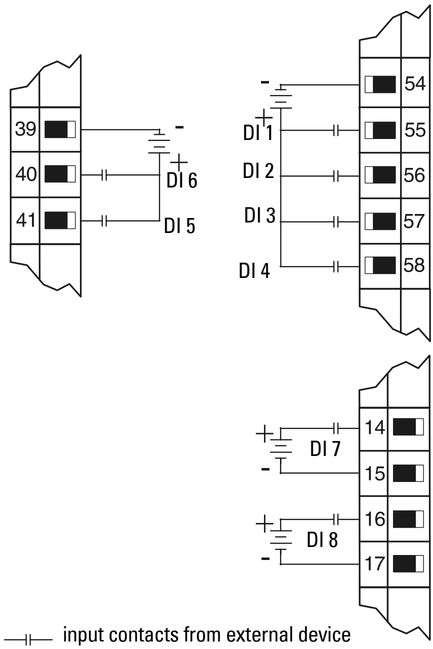



**Example Wiring**

Shown to the left is an example of all eight discrete inputs wired using the 24 VDC rails on the SITRANS LUC500.
Use this wiring model if your external device does not provide power to the discrete inputs.

Wiring

## Wiring Example – Powered by External Device



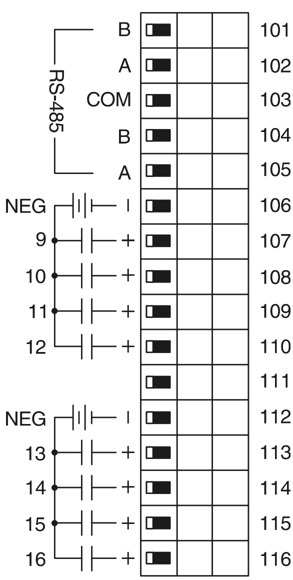

**Example Wiring**

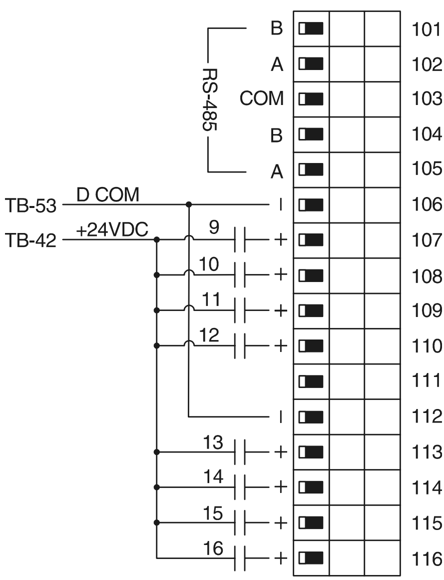
Shown to the left is an example of all eight discrete inputs wired using power supplied from an external source.
Use this wiring model if your external device provides its own power to the discrete inputs.

## Discrete Input Option Card (Wall mount)

**Note:** If you are wiring the 8DI / 2AI / 2AO Optional Card, see page 28 instead.

**Powered by other sources** | **Powered by the SITRANS LUC500**




Wiring

# Operating the SITRANS LUC500

The SITRANS LUC500 has two modes of operation: RUN and PROGRAM.

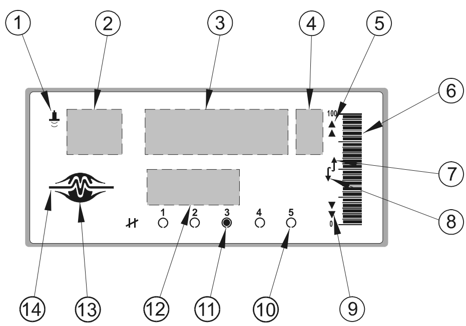
## RUN Mode

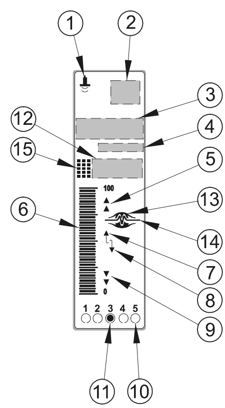
In RUN mode, the SITRANS LUC500 detects material level and provides control functions. The SITRANS LUC500 starts in the RUN mode when power is applied.

System status is shown on the unit's LCD, or on a remote communications terminal.

To return to RUN mode from PROGRAM mode, press .

## Display




| | PROGRAM Mode | RUN Mode |
|---|---|---|
| 1 | index type (see next page) | index type (see next page) |
| 2 | index | index |
| 3 | parameter value | primary reading |
| 4 | units | units |
| 5 | auxiliary function | hi and hi hi alarm designation |
| 6 | n/a | level display |
| 7 | scroll access tag | filling display |
| 8 | scroll access tag | emptying display |
| 9 | n/a | lo and lo lo alarm designation |
| 10 | relay # programmed<br>flashing = unavailable | relay # programmed<br>flashing = unavailable |
| 11 | relay # activated | relay # activated |
| 12 | parameter number | auxiliary reading |
| 13 | n/a | normal operation: |
| 14 | n/a | failsafe operation: |
| 15 | program mode | programming enabled |

**Icons indicating index type edited in PROGRAM mode:**

| Icon | Index Type |
|---|---|
| | measurement point |
| | relay |
| | secondary index |
| mA | mA input or output |

# Readings in RUN Mode

In RUN mode, change the values displayed by using keys on the hand programmer. All readings are shown in the Auxiliary field except for the totalizer and P920.

| Key | Function | | P# |
|---|---|---|---|
| % | Toggle Readings between percent and units | | P920 |
| | Level | Space or Distance[1] | |
| | 0 to 100% | 100 to 0% | |
| 2 + 1 2 3 4 5 | Accumulated pump running hours[2] for numbered pump | | P310 |
| 2 + 1 2 3 4 5 | Hold number key for five seconds to display the number of accumulated pump starts[2] for numbered pump | | P311 |
| 1 | 8-digit totalizer, uses index and reading areas, press again to toggle, P737 sets default<br>Used for OCM and Pumped Volume. | | P322,<br>P323,<br>P920 |
| 3 | Head measurement | | P926 |
| 4 | Instantaneous flow based on head (OCM) | | P925 |
| 5 | mA Output value | | P203 |
| 6 | Temperature | | P664 |
| 7 | Rate of level change | | P707 |
| 8 | Failsafe Time Left (in %). When the Reading is updated, this value (Auxiliary Reading) resets to 100 and begins to decrease until the next valid measurement is made. If the Failsafe Time Left reaches 0, **LOE** flashes in the Reading display. | | |
| 8 | Hold for four seconds to show echo confidence | | P805 |
| 9 | Time (hh:mm) | | P009 |
| 0 | Date (dd:mm or mm:dd as P736) | | P008 |
| P + ### | Display the value of the entered parameter which is global or indexed by transducer | | typed number |
| P | Auxiliary reading, displays parameter specified in P731 | | P731 |
| | Distance | | P923 |

1. Distances less than 0.3 m (12”) from the transducer face cannot be reliably measured so a 0% reading cannot be achieved during **Distance** operation.
2. If the associated relay is programmed for pump control.

# Status Parameters

Status parameters give the operating status of the SITRANS LUC500. You can access parameters with Dolphin Plus or the hand programmer. Remote SCADA system access is also possible.

| Parameter | | Values |
|---|---|---|
| P149 | Energy Override Status | 0 – no override<br>1, 2, 3 – override on |
| P169 | Flow Condition | 0 – normal operation<br>1 – overflow state<br>2 – underflow state |
| P186 | Pump Low Efficiency Counter | Shows number of times pump has failed to meet the efficiency threshold |
| P203 | mA Output Value | 0 to 22 – Current mA output |
| P254 | Scaled mA Input Value | 0 to 9999 – Current mA input after scaling |
| P275 | Scaled Discrete Input Value | Shows current value of discrete input, values vary by DI function |
| P322 | LCD Total Low | The last four digits of the totalizer |
| P323 | LCD Total High | The first four digits of the totalizer |
| P341 | Run Time | The number of days the SITRANS LUC500 has been operating |
| P342 | Start Ups | The number of times power has been cycled |
| P424 | Trigger State | 0 – normal<br>1 – activated |
| P434 | Trigger Status | 1 – trigger asserted<br>2 – trigger negated |
| P452 | Number of Entries | Number of entries in the indexed data log |
| P510 | Pump Failed Status | 0 – normal<br>1 – fault |
| P515 | Pump Remote Control Status | 0 – local<br>1 – remote |
| P519 | Power Failure Status | 0 – normal<br>1 – power failure |
| P520 | Pump Available | 0 – not available<br>1 – available |
| P664 | Temperature | Current temperature measured by transducer |
| P707 | Rate Value | Current rate of material level change |
| P708 | Volume Rate Display | Current rate of material volume change |
| P729 | Scan Time | Seconds since last level scan |
| P806 | Echo Strength | Strength of primary echo |
| P920 | Reading Measurement | Current primary reading |
| P921 | Material Measurement | Current level from P007–Span |
| P922 | Space Measurement | Empty space above the material level |
| P924 | Volume Measurement | Current volume value, if programmed |
| P925 | Flow Measurement (OCM) | Current flow value, if OCM programmed |
| P926 | Head Measurement (OCM) | Current level, if OCM programmed |
| P927 | Distance Measurement | Distance from transducer face to material |

**Note:** When in RUN mode, the SITRANS LUC500 only displays global parameters in the auxiliary field. Use PROGRAM mode to display other parameter values.

# Controlling the Display



RUN mode provides numerous parameters and variables that you can track on the display (see Display on page 34).

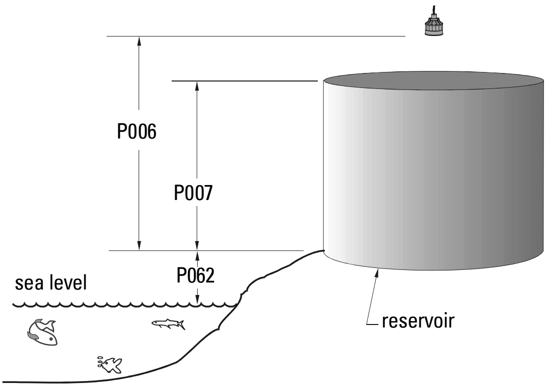
The LCD displays **EEEE** if a value is too long.

### Adjusting the primary reading for four-digit LCD readout:

| Parameter | | Action |
|---|---|---|
| P060 | Decimal Position | Sets maximum number of decimals |
| P061 | Convert Reading | Scales the reading to fit |
| P062 | Offset Reading | Shifts the reading up or down by a fixed amount |

### Example

To reference the displayed level to sea level, enter the distance in Units (P005), between Empty (P006) and sea level. (Enter a negative value if Empty is below sea level.)




P062 is the distance between sea level and Empty.

# Auxiliary Reading

The Auxiliary Reading area of the LCD displays parameter values while leaving the primary reading on the screen.

**Note:** The parameters shown in the auxiliary reading field are indexed as follows:
- global
- by transducer
- by level point.

### Setting the Default Auxiliary Reading

To maintain a constant variable display in the auxiliary reading area, set the default.

Example: To leave the level reading on the screen and view the echo confidence in the auxiliary reading field, set the following parameter:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P730 | G | 805 | Auxiliary field defaults to P805 |

### Setting a Specific Auxiliary Reading

To display a second auxiliary reading, press P in RUN mode.

Example: To set P to display the current temperature, go to P731:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P731 | G | 912 | Shows P912–Transducer Temperature |

## Multiple Readings

During **differential**, **average**, or **sum** operation (P001 = 4, 5, or 10), the display scrolls sequentially through Point Numbers 1, 2, and 3. Point 3 is the difference between (or average of) Points 1 and 2.

### Changing Number Scrolling Speed:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P732 | G | 5 | Hold each value for 5 seconds |

# Optional Features

The SITRANS LUC500 offers optional features which change parameter indexing.

For example, adding the Dual Point feature causes all transducer-related parameters to be indexed by two instead of one. So, P004 is indexed by two instead of global.

Also, when a discrete input option card is installed, P500 is indexed by 16 instead of 8.

Sometimes an optional feature will create a secondary index. The mark icon → on the LCD shows whether you are changing a primary or secondary index.

Example: When the Dual Point feature is added to the SITRANS LUC500, all OCM characterization curves are indexed by 2. The primary index is the transducer, and the secondary is the characterization breakpoints.

See Parameter Indexing on page 45 for more information.

# PROGRAM Mode

The SITRANS LUC500 is programmed by setting its parameters to match your specific application. Most parameters are indexed, allowing you to set the parameter to specific conditions and to more than one input or output. When the SITRANS LUC500 is in PROGRAM mode, you can change these parameter values and set operating conditions.

Please refer to the Parameter Reference section on page 171 for a full listing and explanation of parameter values.

**Notes:**

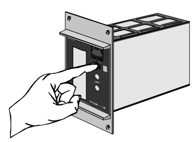
- To activate PROGRAM from RUN mode
  Rack or Panel Mount: Press the program button on the front of the device, and look for the program icon ( ) on the display. Then press PROGRAM and DISPLAY .
  Wall Mount: Press PROGRAM and then DISPLAY .
- The display briefly reads --- while the measurement reading is verified. Reading level and other data is displayed and programmed relays are operated.
- Placing a programmed unit that is in normal operation into PROGRAM mode de-energizes all control relay outputs. Be sure to bypass the SITRANS LUC500 while programming it.
- Entering program mode will retain all operating data in memory, hold alarm relay status at last known values, and detect but not act on discrete inputs.

# Starting Program Mode

If the SITRANS LUC500 is idle in PROGRAM mode for more than 5 minutes, it will return to RUN mode.

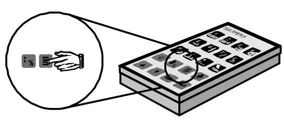
### Rack or Panel Mount

To enter program mode on a rack or panel mount unit press the program button on the front of the unit (shown at right). The program icon ( ) appears when the unit can be placed in program mode.



### Wall Mount

The wall mount has no program button and is always ready for programming. Aim the hand programmer at the display and press the program keys.



The program button allows multiple units to be installed close together and still be programmed one at a time. Disable nearby units to avoid inadvertent programming when using the infrared handheld programmer.

**Note:** Unless otherwise noted, each valid key press should produce a change in the LCD. Verify when programming the unit.

# Dolphin Plus

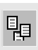
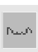
Dolphin Plus is the primary method of changing SITRANS LUC500 parameters. Dolphin Plus lets you access the SITRANS LUC500 from a PC or on-site with a laptop and change SITRANS LUC500 parameters.

Most examples in this manual use the icons from the hand programmer but nearly all functions are also available through Dolphin Plus.

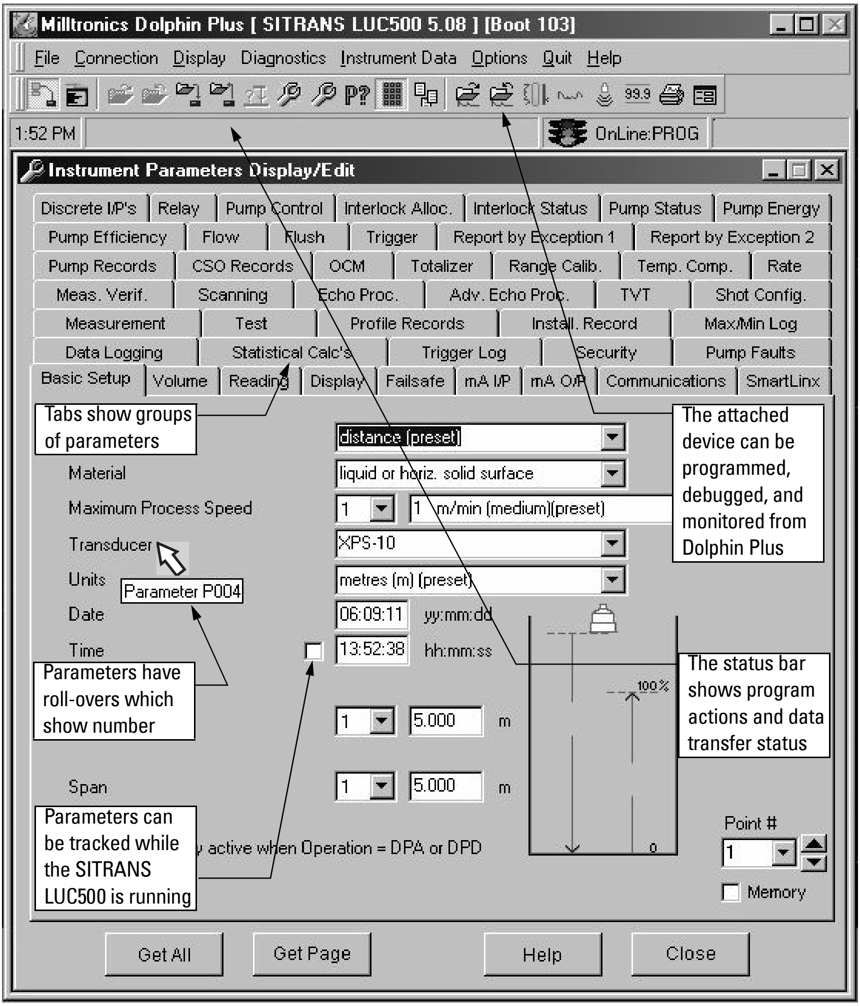
**Note:** Dolphin Plus is ordered separately from Siemens Milltronics.

# Dolphin Plus Toolbar Buttons

The toolbar buttons provide quick access to Dolphin Plus features.

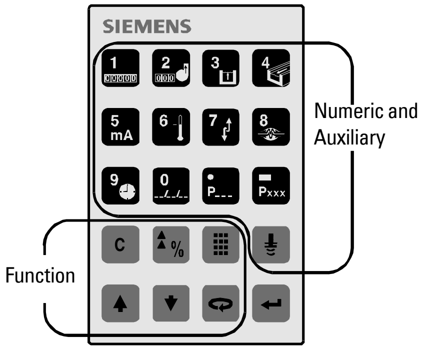
| Button | Result |
|---|---|
|  | communicate with instrument–toggle |
|  | monitor communications |
|  | send parameter set to instrument |
|  | save parameter set to file |
|  | open the quick start wizard |
|  | open the tabbed parameters window |
|  | find a parameter in the tabbed parameters window |
|  | toggle program mode and run mode |
|  | open the reporting windows |
|  | load an echo profile from a file |
|  | save the current echo profile to a file |
|  | open the vertical echo profile and tank mimic window |
|  | open the horizontal echo profile window |
|  | take a measurement with the current transducer |
|  | open the reading values (distance measurement) window |
|  | print current echo profile |
|  | open the Echo Info Editor window |

# Changing Parameters (Dolphin Plus)



# Hand Programmer

**Note:** The hand programmer is ordered separately from Siemens Milltronics.




| Key | Programming Mode | Run Mode |
|---|---|---|
| 1 | 1 | 8-digit Totalizer (toggle) |
| 2 | 2 | Pump Running Time |
| 3 | 3 | Head |
| 4 | 4 | Flow based on Head |
| 5 mA | 5 | mA Output |
| 6 | 6 | Temperature |
| 7 | 7 | Rate of Change |
| 8 | 8 | Failsafe Time Left |
| 9 | 9 | Time |
| 0 | 0 | Date |
| P | Decimal Point (TVT left) | Parameter Value |
| P | Negative Value (TVT right) | Material Level (P731) |
| | Fire Transducer | Distance |
| | Run Mode | Program Mode (Key 1) |
| ▲% | Units or % | Units or% (Program Mode (Key 2)) |
| | Next Display Field | Pause Display Toggle |
| ▲ | Increase Value | Next Index |
| ▼ | Decrease Value | Previous Index |
| ↵ | Enter Value | |
| C, ↵ | Clear to Preset | |

# Changing Parameters (Hand Programmer)

1. From RUN mode, press PROGRAM and then press DISPLAY to enter PROGRAM mode.

**Note:** If Parameter Value alteration is not permitted, access the Lock parameter (P000) and enter the security code (see Programming Security).

2. Press DISPLAY to select the Parameter Number field (see page 34)
3. Type the Parameter Number (e.g. 110)
   When you type the third digit the value for that parameter is shown
4. For lower numbered parameters, such as 007, you can type the number **7** and then press DISPLAY to show that parameter.
5. Type the new value, and press ENTER.
   The SITRANS LUC500 interprets the value and either accepts it, or replaces it with a valid value. See *Parameter Reference* on page 171 for descriptions of values.

### Helpful Hints

- The “?” icon indicates that the SITRANS LUC500 has accepted the value but that it conflicts with other values entered. Double-check your programming.
- By default the scroll keys ( or ) only show the Quick Start parameters and any that have been changed.
- P733 sets all parameters to be scroll-accessed.

# Security

The Lock parameter P000 secures the SITRANS LUC500 against parameter changes. The unit can still be put into PROGRAM mode when locked, and parameter values can be viewed, but no parameter values can be changed.

Set P000 to **1954** to enable programming.

P000 (1954) is a fixed value password. Therefore, you should use other means to secure the SITRANS LUC500 if security is a concern.

### Simulation

P000 Lock also controls how simulations affect control relays. By default, control relays are unaffected by simulation levels but if P000 is set to **-1,** they react to the simulated level. See *Simulation* on page 117 for running a simulation.

# Using Units or Percent (%)

Many parameters can be viewed in either measurement units (P005) or percent. View the parameter and then press the MODE key to toggle between units and percent. The LCD shows the selected measurement type, either units (m, mm, ft, etc.) or percent (%).

Percentage is also available when showing flow and volume with 100% based on the parameter that defines the maximum.

| Measurement | Maximum |
|---|---|
| Volume | P051 |
| Flow | P604 |

# Parameters Types

### View Only Parameters

Parameter values indicating status only. They cannot be altered.

### Global Values

Parameter values common for all inputs and outputs on the SITRANS LUC500.

When a global parameter is accessed, the index display automatically disappears. When a non-global parameter is accessed, the index display reappears showing the last index number.

# Parameter Reset

### Returning a parameter to factory default:

- Display the appropriate parameter number
- Display the appropriate index value (if required)
- Press CLEAR [C]
- Press ENTER [↵]

### Master Reset (P999)

Returns all parameters to original values.

Use Conditions:

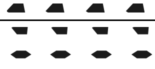
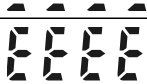
- before initial system installation
- following a software upgrade

If complete reprogramming is required, use Dolphin Plus to store and retrieve parameters.

When the dual point option is enabled P999 is indexed by transducer. Use index **00** to reset the entire SITRANS LUC500.

# Display Readout

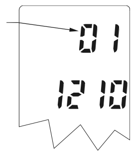
The following readouts are shown when the SITRANS LUC500 cannot display a number.

| Display | Meaning |
|---|---|
|  | parameter has not been set |
|  | all values not same when viewing index 0 |
|  | value too large for 4-digit display |

# Parameter Indexing

Parameters are indexed if they can apply to more than one input or output. The index value defines the input/output for that parameter. Indexed parameters contain a value for each index, even if that index is not used.

index field




Rack and Panel display shown.

For example, to change the Relay Control Function (P111) for relay three you must ensure that **03** is displayed in the index field before you change the parameter value.

In this manual, index values are shown in brackets after the parameter number. So, P111[3] refers to parameter 111, index value 3.

**Notes:**

- Transducers are always indexed when the dual point option is enabled.
- An indexed transducer is commonly referred to as a Point (short for measurement point). The term Point Number refers to indexed transducers.
- To set all indexed values for a given parameter to the same value use index **0**
- Transducer parameters are indexed only if Operation (P001) is set to **Difference** (4), **Average** (5), or **Sum** (10) on the base unit.
- The number of index values can change for a parameter when optional features are installed such as dual point software or a discrete I/O option card. The examples in this manual assume a standard unit unless noted otherwise.

### Accessing a Parameter Index:

1. Press DISPLAY **once**
2. Enter the parameter number
3. Press **twice**
4. Press the number of the required index, **or** press ARROW keys or to scroll through the available values

**Note:** For optimum performance, set values accurately for indexed parameters. Ensure that the correct index value is being changed for each parameter value.

# Primary and Secondary Indexes

**Primary Index:** relates to direct input or output and can refer to relays, communications ports, and other parameters. In parameters that allow secondary indexes, the primary index is often referred to as a point.

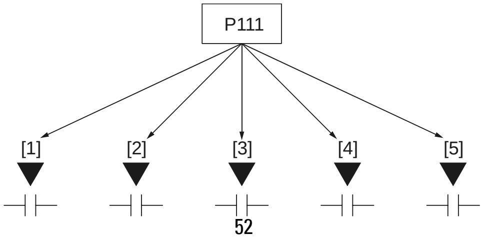
**Secondary Index:** relates to previously indexed parameters where the parameter requires a second index, permitting multiple values on an indexed input or output.

### Accessing a Secondary Index

1. Press MODE and then press DISPLAY to activate secondary index. The → icon appears under the index field.
2. Enter the secondary index, and then enter the values to set the secondary index.

### Primary Index

Example Setting: P111[3] = 52 means:



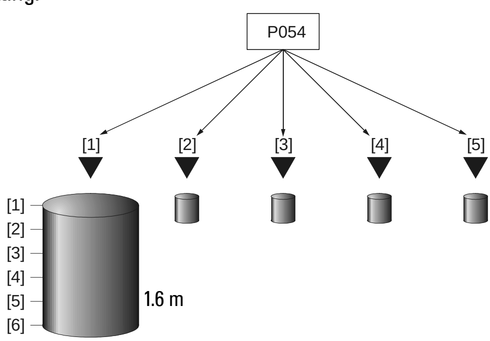

- P111 sets the Relay Control Function
- P111(3) = 52 sets Relay #**3** to a value of **52**

### Secondary Index

Parameters with a secondary index permit multiple values for a primary index (point). For example, a volume calculation based on vessel characterization breakpoints requires a distinct set of breakpoints for each measured point.

Thus, the primary index refers to the measurement point, and each secondary index refers to a characterization breakpoint value.

Example Setting:




- P054 sets the Breakpoint Levels
- P054(1,5) = 1.6 m sets breakpoint 5 on transducer 1 to 1.6 m

The data access method used determines how indexes are handled in the memory map. When you are changing a secondary index, ➔ is shown on the LCD.

# Starting Measurement

The start up state of the SITRANS LUC500 depends on whether or not it has the dual point optional feature installed. See *Appendix E–Updating Software* on page 315 for details on installing the dual point option.

# Single Point Model

The SITRANS LUC500 starts in distance mode with the transducer preset for the XPS-10 and an empty distance of 5 meters. Change the following parameters to reflect your application parameters. For example:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | G | 1 | Operation = level |
| P002 | G | 1 | Material = liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 104 | Transducer = XPS-15 |
| P005 | G | 1 | Units = meters |
| P006 | G | 12 | Empty = 12 m |
| P007 | G | 10 | Span = 10 m |

# Average, Differential, or Sum

To enable average, differential, or sum operation with a single point SITRANS LUC500 set P001 to 4, 5, or 10 and connect two transducers of the same type. All of the relevant parameters then become indexed by the correct number, one of:

| Index | Description |
|---|---|
| 2 | indexed by transducer 1 or 2 |
| 3 | indexed by level measurement<br>1 = transducer 1<br>2 = transducer 2<br>3 = calculated level (average, difference, or sum) |

# Dual Point Model

Support for two transducers is an optional feature available at additional cost from Siemens Milltronics. See *Appendix E–Updating Software* on page 315 for information on ordering and enabling optional features.

A dual point SITRANS LUC500 starts in an OFF state and does not take level measurements. To set up measurement you must configure the basic parameters described below.

If your application uses two measurement points then you have to provide the basic information for each measurement point separately:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | 1 | 1 | Operation = level |
| | 2 | 6 | Operation = OCM |
| P002 | 1 | 1 | Material = liquid |
| | 2 | 1 | |
| P003 | 1 | 2 | Maximum Process Speed = medium |
| | 2 | 3 | Maximum Process Speed = fast |
| P004 | 1 | 104 | Transducer = XPS-15 |
| | 2 | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | 1 | 12 | Empty = 12 m |
| | 2 | 4 | Empty = 4 m |
| P007 | 1 | 11 | Span = 11 m |
| | 2 | 3.5 | Span = 3.5m |

## Average, Differential, or Sum

To enable average, differential, or sum level operation with an SITRANS LUC500 that has the dual point option installed set P001[3] to 4, 5, or 10 and connect two transducers. All of the relevant parameters then become indexed by the correct number, one of:

| Index | Description |
|---|---|
| 2 | indexed by transducer 1 or 2 |
| 3 | indexed by level measurement<br>1 = transducer 1<br>2 = transducer 2<br>3 = calculated level (average, difference, or sum) |

## Response Rate (set using Parameter P003)

The response rate of the device influences its accuracy. Use the slowest rate that will still keep pace with the application.

The response rate is also important if any functions are tied to the filling or emptying indicators.

## Dimensions

The dimensions of the wet well or reservoir (except empty and span) are relevant to volume calculations.

Volume is used when you want to report the level value in terms of volume or if you want the pumped volume function to totalize pumped volume or report pump efficiencies.

## Failsafe

Failsafe parameters ensure the devices controlled by the SITRANS LUC500 default to an appropriate state if no valid level reading is available.

By default, if an error condition is detected, the display and relay status are held at their last known values and the Failsafe Timer (P070) is activated. If the Failsafe Timer expires and the unit is still in an error condition then P071–Failsafe Material Level determines the level reading.

Control the reaction of the SITRANS LUC500 to extended error conditions by configuring parameter P071–Failsafe Material Level and ensuring that the fail state is optimal for your application.

Control the reaction of each relay by using P129–Relay Failsafe. See *P129 Relay Failsafe* on page 189 for more information.

If Failsafe Operation activates frequently, see *Appendix C–Troubleshooting* on page 301.

# Relays

Relays are the primary controls of external devices such as pumps or alarms. The SITRANS LUC500 comes with extensive control and alarm functions.

**Communication is also available using:**

- mA input / output (see page 60)
- Modbus communications (see page 121)
- SmartLinx industrial bus communications (see page 121)

# Terminology

**The following terms are used when talking about relay states:**

Tripped: when a setpoint value is passed that function is tripped (P112, P113, P114, P115, P146)

Activated: when an event's setpoint is tripped that event is activated

Asserted: when a control or alarm function is activated that function is asserted (P100, P110, P111)

Energized: when a function is asserted it either energizes or de-energizes the relay (P118, P119)

Contacts: when the relay is energized or de-energized the contacts are then opened or closed. This relates to the form type of the relay.

# Relay States

The relays on the SITRANS LUC500 are completely programmable to allow for any control scheme.

| Rack or Panel Mount | Wall Mount |
|---|---|
| Relay 1 to 4–NO (Form A) | Relay 1 to 4–NO (Form A) |
| Relay 5–NC (Form B) see note below | Relay 5–NO / NC (Form C) |

**Notes:**

- On the rack or panel mounts, relay 5 is a Form B (NC) but is reversed during operation so that it is programmed as a Form A (NO). Its default state changes based on whether the instrument has power:

| Power | Relay 5 |
|---|---|
| on | NO (Form A) |
| off | NC (Form B) |

# Parameters

There are a few parameters that change the way relays react during normal conditions:

### P100–Preset Applications

Sets the SITRANS LUC500 to a preset application. These preset applications allow you to quickly set up the SITRANS LUC500 with a minimum number of parameters.

### P111–Relay Control Function

Sets the default state differently, depending on whether the relay is programmed as an alarm or a control.

### P111–Alarm Functions

When an alarm function is asserted, the relay contacts open. When the instrument is operating normally (no alarms), the relay contacts are closed.

### P111–Control Functions

When a control function is asserted, the relay contacts close. When the instrument is at rest (no controls operating), the relay contacts are open.

### P118–Relay Output Logic

P118–Relay Output Logic, will reverse the logic (normally-open to normally-closed or vice versa).

### P129 – Relay Failsafe

Relay Failsafe changes individual relays reactions to a failsafe condition on the instrument.

## Relay Wiring Test

You can test the wiring in your application by forcing a relay control function using P119–Relay Logic Test. This parameter forces the condition that controls a relay, such as a level alarm or pump control setpoint, and ensures that all the relay programming and wiring is working correctly (i.e. ON does what you think it should, as does OFF).

Use P119 as a final test once relay programming is done.

# Relay Activation

### Relay Setpoints and Functionality

When a setpoint is reached, the corresponding action is taken. The setpoint can be an ON or OFF setpoint related to a process variable or a timed setpoint based on interval and duration.

### Function is Asserted

Functions affected by setpoint are configured by parameters that determine application requirements such as timing. P111 Relay Control Function (see page 184) sets the function requirements. Other function parameters are:

- P132–Pump Start Delay
- P133–Pump Power Resumption Delay
- P645–Relay Duration

### Relay Logic is Modified

Normally alarm relays are energized and control relays are de-energized. This can be reversed using P118–Relay Output Logic.

# Relay Failsafe

### P129–Relay Failsafe

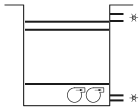
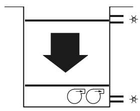
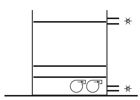
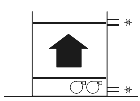
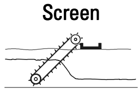
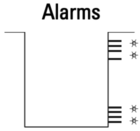
Adjusts how individual relays react to a failsafe condition. Relays can be set to:

| | |
|---|---|
| OFF | control is by P071–Failsafe Material Level |
| HOLd | keeps the relay in the current state |
| dE | de-energizes the relay (default for pump controls) |
| En | energizes the relay |

# Preset Applications



The preset applications that come with the SITRANS LUC500 set up the relay parameters to predetermined values. These values are shown below:

| Value | # | Parameters affected | | | | | |
|---|---|---|---|---|---|---|---|
| Off | 0 | All relays set OFF | | | | | |
| Wet Well 1  | 1 | Pump down with the following level settings: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P111 | 52 | 52 | 1 (H) | 1 (L) | 0 |
| | | P112 | 70% | 80% | 90% | 10% | – |
| | | P113 | 20% | 20% | 85% | 15% | – |
| Wet Well 2  | 2 | Pump down with the following level and rate settings: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P111 | 52 | 52 | 1 (H) | 1 (L) | 0 |
| | | P112 | 80% | 80% | 90% | 10% | – |
| | | P113 | 20% | 20% | 85% | 15% | – |
| | | P121 | 1 | | | | |
| | | Because the pumps are started by rate you must change P703 to appropriate values. | | | | | |
| Reservoir 1  | 3 | Pump up with the following level settings: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P111 | 52 | 52 | 1 (H) | 1 (L) | 0 |
| | | P112 | 30% | 20% | 90% | 10% | – |
| | | P113 | 80% | 80% | 85% | 15% | – |
| Reservoir 2  | 4 | Pump up with the following level and rate settings: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P111 | 52 | 52 | 1 (H) | 1 (L) | 0 |
| | | P112 | 20% | 20% | 90% | 10% | – |
| | | P113 | 80% | 80% | 85% | 15% | – |
| | | P121 | 1 | | | | |
| | | Because the pumps are started by rate you must change P702 to appropriate values. | | | | | |
| Screen  (P001=4 only) | 5 | Differential control of a screen or rake: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P110 | 3 | 1 | 2 | 3 | 0 |
| | | P111 | 50 | 1 (H) | 1 (L) | 1 (H) | – |
| | | P112 | 80% | 90% | 10% | 90% | – |
| | | P113 | 20% | 85% | 15% | 10% | – |
| Alarms  | 6 | General alarms at four setpoints: | | | | | |
| | | Parameter | Relay # | | | | |
| | | | 1 | 2 | 3 | 4 | 5 |
| | | P111 | 1 (H) | 1 (L) | 1 (HH) | 1 (LL) | 0 |
| | | P112 | 80% | 20% | 90% | 10% | – |
| | | P113 | 75% | 25% | 85% | 15% | – |

# Discrete Inputs

The discrete inputs on the SITRANS LUC500 allow the unit to be more flexible by interlocking control functions with external conditions.

Use the discrete inputs to:

**Report Overflow / Underflow**

Using an alternate measurement technology, such as the CLS 100 capacitance point level sensor. See *Setting Pump with Float Backup* on page 92 for details.

**Report Power Failure**

Also keep the SITRANS LUC500 from attempting to run the pumps during the power outage. See *Reporting Power Failure* on page 55 for details.

**Determine Pump Control Source**

Using a switch to determine how the pumps are controlled. See *Determining Pump Control Source* on page 55 for details.

**Report and Reset Pump Status**

Using connections on the pumps to detect when there is a failure. See *Reporting Pump Status* on page 53 for details.

**Store and Forward Frequency Inputs**

Interpret frequency inputs as a scaled value and make that value available to SCADA systems. See *Configuring Frequency Inputs* on page 58.

**Store and Forward Totalized Inputs**

Totalize discrete input pulses and make the total available to SCADA systems. See *Configuring Totalizer Inputs* on page 59.

**Report any Other Event**

You can use a discrete input to report on any external event by setting up a report by exception to trigger from the discrete input. See *Report by Exception* on page 72.



# Reporting Pump Status

Used to confirm a pump's operation and to remove it from the duty schedule if it is not operating correctly.

The interlock events that can remove a pump from the duty schedule are[1] a failure to start or a pump fault. Explanations of both events follow.

## Failure to Start

Wire the SITRANS LUC500 to the motor control circuit so that it reports the status of the pump starter. This input is used to determine if the pump is runs when the SITRANS LUC500 tells it to. You can also use an inline flow switch to report the pump running status.

1. A pump efficiency event can also remove a pump from the duty schedule. See also *Pump Efficiency* on page 68.

To configure discrete input five to report the running status of the pump connected to relay three:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P270 | 5 | 2 | Use DI 5 as NO |
| P503 | 3 | 5 | Set relay 3 to interlock with DI 5 |
| P504 | 3 | 4 | Wait 4 seconds for drive to spin up |

So, the pump control associated with relay three is monitored and the state of discrete input five (P275[5]) changes when the pump is commanded to run.

If the discrete input does not show a change four seconds after the pump is commanded to run then that pump is removed from the duty cycle until the fault condition is reset. This condition is reset by setting P510–Pump Failed Status to zero (0).

# Fault

Use P505–Pump Fault **A** Allocation, P506–Pump Fault **B** Allocation, or P507–Pump Fault **C** Allocation. The SITRANS LUC500 can handle up to three fault conditions per pump. Faults A and B interlocks are watched continuously and can report a failure, and remove a pump from the duty schedule, even when that pump is not running. Pump Fault C Allocation, like the pump running fault, is only tested after some time elapses after pump start (time set by P508).

To configure discrete inputs three and four to report both **Fault A** and **Fault B**:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P270 | 3 | 3 | Use DI 3 as NC |
| P270 | 4 | 3 | Use DI 4 as NC |
| P505 | 2 | 3 | Set relay 2 to Fault **A** on DI 3 |
| P506 | 2 | 4 | Set relay 2 to Fault **B** on DI 4 |

The status parameters are latched and must be reset before the pump(s) will resume operation.

Use P510–Pump Failed Status to determine if a pump has failed and either…

- P513–Pump Fault **A** Status, or
- P514–Pump Fault **B** Status, or
- P516–Pump Fault **C** Status

…to determine if it was due to a pump fault.

# Fault Timers

Fault timers (P541 to P545) determine the length of time in seconds that each pump fault indicator must be on before the SITRANS LUC500 will flag a pump fault and remove the associated pump from service.

# Pump Reset

There are four ways to reset a pump failure state:

1. P510–Pump Failed Status

Place the SITRANS LUC500 in program mode and view P510. This parameter will show **1** if any of the pumps are in a failed state.

To reset an individual pump, set P510[i] to **0** where **i** represents the index of the pump's relay. To reset all of the pumps, set P510[0] to **0**.

2. Reset push button connected to a Discrete Input
To make resetting the pumps easier, attach a push-button to a discrete input and program it with P509–Pump Reset Allocation. This allows an operator to reset the pumps without using the hand programmer or Dolphin Plus.

3. Through Communications
Use the built in Modbus register map to review the pump control and status words at registers R41,400 to R41,404. Each register relates to one of the relays. If bit 16 of a register is set to **1** then that pump has failed. To reset the pump, write a **1** to bit 12 , **1** to bit 13, and **0** to bit 16 (hex value of 1800). See Communications Reference section for details.

4. Through Pump Fault Reset Modes (P546 to P550)
Pump Fault Reset Modes determine when the SITRANS LUC500 will reset the pump. The pump state can be reset on power-up or when fault indicator has cleared. The actions can be combined so there will be a reset at power up and when the fault clears.

**Note:** P546 Pump Running Fault Reset Mode can only be reset on power-up.

The number of auto-resets performed by the SITRANS LUC500 can be limited by using Pump Auto-Reset Limit (P551). The number of Auto-resets is recorded in Pump Auto-Reset Count (P554). After the limit is reached, a manual reset of the pump is required using methods 1, 2, or 3 above. As well, Pump Auto-Reset Count (P554) **must** be reset to zero (0) or the pump will not reset automatically.

Discrete Inputs

# Reporting Power Failure

Used to keep the SITRANS LUC500 from running the pumps when a power failure occurs and the SITRANS LUC500 is supplied with backup power but the pumps are not.

If the SITRANS LUC500 attempts to run the pumps, any efficiency, run status, or fault interlocks will erroneously flag all of the pumps as failed and remove them from the pump sequence. This results in no pumps being available until a reset is performed.

Use P502–Power Failure Allocation to detect a power failure event and ignore pump interlocks. To set discrete input eight to detect a power failure condition:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P270 | 8 | 3 | Use DI 8 as NC |
| P502 | G | 8 | Use DI 8 as power failure detection |

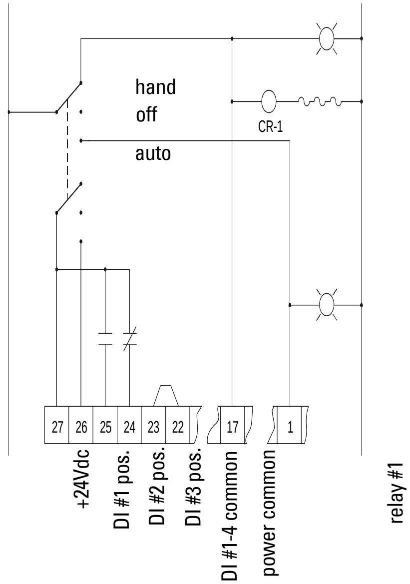
# Determining Pump Control Source

Used to determine from where a pump is controlled. Generally, pumps are controlled from a manual switch, the SITRANS LUC500's pump control algorithms, or from a remote SCADA system.

You can use discrete inputs to determine which control source runs the pumps.

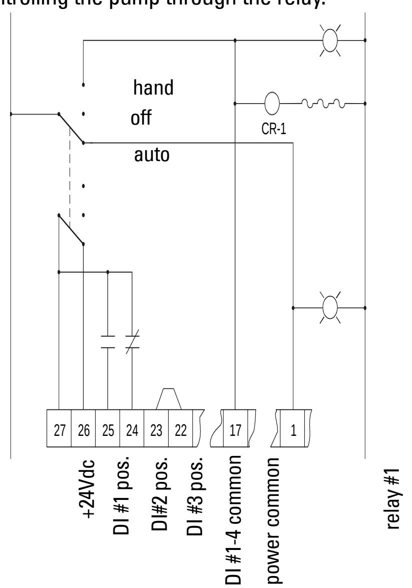
# Hand Example

A Rack mounted SITRANS LUC500 wired for a hand / off / auto switch connected to discrete input 1 and a pump connected to relay 1. Control is set to HAND and the pump is currently switched off.




# Auto Example

A Rack mounted SITRANS LUC500 wired for a hand / off / auto switch connected to discrete input 1 and a pump connected to relay 1. Control is set to auto with the SITRANS LUC500 controlling the pump through the relay.



### Manual Override Switch

- Use P500–Pump Auto Allocation to determine which discrete input is connected to the Auto / Manual switch.

**Note:** For P500–Pump Auto Allocation, **1** is the normal state (pump in auto mode) and **0** is the exception state (pump in manual mode).

### Remote Control

- Use P501–Pump Remote Control Allocation to determine the discrete input used to set remote control (available / not available).

You can use the Pump Control Source (P520 to P524) parameters to determine where to control a pump. Use:

- P520–to determine if the pump is available
- P521–to determine if the pump is in **local–auto**
- P522–to determine if the pump is in **local–manual**
- P523–to determine if the pump is in **remote–auto**
- P524–to determine if the pump is in **remote–manual**

**Note:** Parameters P521 to P524 are mutually exclusive. Only one of these parameters will ever be set to **1** at a time.

See *Parameter Reference* on page 171 for parameter details.

## Wiring the Discrete Inputs

The discrete input contacts are either normally-open or normally-closed when the system state is normal. The normal state refers to standard operation with the SITRANS LUC500 sensing the material level and controlling the pumps.

**Example:** The normal state for a pump is **operational** and the contacts on the discrete input are wired as normally open.

See *Installation* on page 6 for complete details on wiring the discrete inputs.

## Programing the Discrete Input Logic

The P270 series of parameters allows for control over the discrete input.

| If the DI is… | Set P270 to… |
|---|---|
| Normally Open | P270 = 2 |
| Normally Closed | P270 = 3 |

The current value of the discrete input is reported in P275:

| P275 is… | The SITRANS LUC500 is in… |
|---|---|
| 0 | Normal State |
| 1 | Exception State |

**Example:** The pump interlock is programmed to return **0** for the normal state and **1** for the fault state.

# Testing the Interlock

Once wired and programmed, test the interlocks to verify operation.

Use P270–Discrete Input Function to force the input ON (value = 1) or OFF (value = 0) and verify that the unit responds as expected.

Testing the interlocks is part of a complete system test as described in *Testing the Configuration* on page 117.

# Configuring Frequency Inputs

Devices that provide a frequency output (ie: wind gauges) can be connected through discrete inputs 7 or 8 and scaled to a value which is then available through communications to a SCADA system.

To configure discrete input 7 as a wind gauge:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P270 | 7 | 5 | Selects frequency input |
| P271 | 7 | 0 | Do not apply a 0 Hz offset |
| P272 | 7 | 120 | Wind speed at maximum frequency |
| P273 | 7 | 15.0 | Output frequency at max. wind speed |
| P274 | 7 | 0 | No damping applied |

This example shows a simple frequency input. Below are examples of more complex inputs where a value of 0 Hz still reads a value and where a positive frequency should read 0.

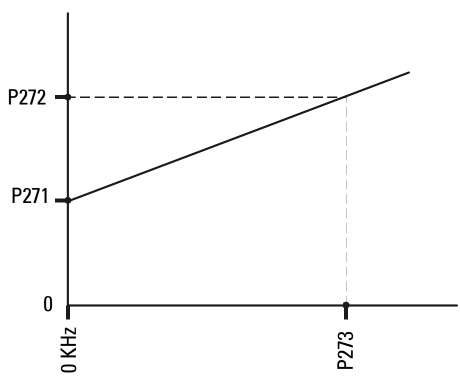


## Scaling Frequency Inputs

### Minimum Frequency = 0

To set discrete input 8 to report a scaled frequency range from 12 to 24 with a maximum input frequency of 10 KHz, use the following settings:

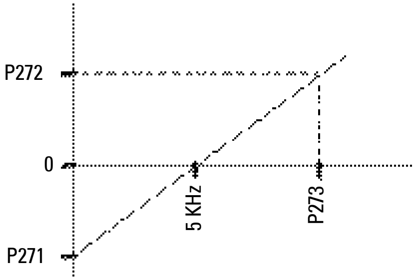
| Parameter | Index | Value |
|---|---|---|
| P271 | 8 | 12 |
| P272 | 8 | 24 |
| P273 | 8 | 10 |



### Minimum Frequency > 0

To set discrete input 8 to report a scaled frequency range from 0 to +12 with a minimum frequency input of 5 KHz and a maximum input frequency of 10 KHz use the following settings:

| Parameter | Index | Value |
|---|---|---|
| P271 | 8 | -12 |
| P272 | 8 | 12 |
| P273 | 8 | 10 |




# Configuring Totalizer Inputs

To totalize pulses detected on discrete input number 8 and multiply every pulse by 4, do the following:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P270 | 8 | 4 | Selects pulse input |
| P272 | 8 | 4 | Add 4 to total for every pulse |
| P275 | 8 | | Shows the total |

# mA Loops

Use the SITRANS LUC500's mA inputs and outputs to integrate it with older equipment.

The base instrument does not come with mA output. This is available on optional cards:

| Card Name | Description | Parameter Index |
|---|---|---|
| 2 mAI / 2 mAO | 2 mA inputs<br>2 mA outputs | 3<br>2 |
| 4 mAI | 4 mA inputs | 5 |
| 4 mAO | 4 mA outputs | 4 |

**Note:** When a mA input parameter is accessed, a **mA** symbol appears in the upper left of the LCD display screen.

## mA Input

The mA input can be used as a level measurement or passed on to a SCADA system.

To pass the mA input on to a SCADA system, read the value from the appropriate communication registers. See *Communications* on page 120 for details.

Using mA Input number one as the first level reading:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P004 | 1 | 250 | Transducer = mA input 1 |
| P250 | 1 | 2 | Scale = 4 to 20 mA |
| P251 | 1 | 0 | 4 mA = 0% of span |
| P252 | 1 | 100 | 20 mA = 100% of span |
| P253 | 1 | 0 | Do not damp the input signal |

Using mA input number two as the second level reading:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P004 | 2 | 251 | Transducer 2 = mA input 2 |
| P250 | 2 | 2 | Scale = 4 to 20 mA |
| P251 | 2 | 0 | 4 mA = 0% of span |
| P252 | 2 | 100 | 20 mA = 100% of span |
| P253 | 2 | 0 | Do not damp the input signal |

# Calibration

Only calibrate the mA inputs if you installed the option card in the field. Any mA inputs shipped from the factory are already calibrated.

### Calibrating 4 mA Input

1. Connect a trusted 4 mA source to the mA inputs on the terminal block
2. Put the SITRANS LUC500 into PROGRAM mode
3. View P260–mA Raw Input to see if it reads 4.0.
   If the reading is correct, then do nothing.
   If the reading is incorrect then continue.
4. View P261–4 mA Trim
5. Press ENTER ↵
6. L.CAL is shown on the LCD

The unit is now calibrated for 4 mA.

### Calibrating 20 mA Input

1. Connect a trusted 20 mA source to the mA inputs on the terminal block
2. Put the SITRANS LUC500 into PROGRAM mode
3. View P260–mA Raw Input to see if it reads 20.0.
   If the reading is correct, then do nothing.
   If the reading is incorrect then continue.
4. View P262–20 mA Trim
5. Press ENTER ↵
6. H.CAL is shown on the LCD

The unit is now calibrated for 20 mA.

# mA Output

Use mA output to send a measurement to another device.

Configuring the mA output to correctly send a 4 to 20 mA signal scaled from 10% to 90% of span of the second transducer:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P200 | 1 | 2 | set to 4 to 20 range |
| P201 | 1 | 1 | send mA proportional to level reading |
| P202 | 1 | 2 | base mA on level point 2 |
| P210 | 1 | 10 | set 4 mA at 10% of span[1] |
| P211 | 1 | 90 | set 20 mA at 90% of span[2] |
| P219 | 1 | 0 | set failsafe action as 0 mA |

1. If the level reading drops below 10% of span then the mA output will drop below 4 mA.
2. If the level reading rises above 90% of span then the mA output will rise above 20 mA.

mA Loops

### Calibrating 4 mA Output

1. Connect the mA receiving device to the SITRANS LUC500
2. Put the SITRANS LUC500 into PROGRAM mode
3. Set P911–mA Output Value to 4.0
4. View the mA level on the receiving device
5. If there is a discrepancy, use P214–4 mA Output Trim to correct the value
   Press MODE and then ARROWs to increase or decrease the trim.
6. Repeat until the mA level on the receiving device equals 4.0 mA

The unit is now calibrated for 4 mA for the receiving device.

### Calibrating 20 mA Output

1. Connect the mA receiving device to the SITRANS LUC500
2. Put the SITRANS LUC500 into PROGRAM mode
3. Set P911–mA Output Value to 20.0
4. View the mA level on the receiving device
5. If there is a discrepancy, use P215–20 mA Output Trim to correct the value
   Press MODE and then ARROWs to increase or decrease the trim.
6. Repeat until the mA level on the receiving device equals 20.0

The unit is now calibrated for 20 mA for the receiving device.

### Verifying the mA Range

To verify that the external device can track the entire 4 to 20 mA range that the SITRANS LUC500 sends, do the following:

1. Use P920 to put the SITRANS LUC500 into Simulation mode (see *Simulation* on page 117)
2. Run the simulation through one complete fill / empty cycle
3. View P911–mA Output Value to verify that it tracks to the simulation
4. View the mA value reported on the external equipment to verify that it also tracks to the simulation

# Volume

Use volume to:

1. Calculate and display volume instead of level. For programming all setpoint parameters in terms of volume units rather than level units.
2. Calculate pumped volume to accomplish the following:
   - Totalize the volume of material that is pumped out of the wet well
   - Set an alarm on pump efficiency

## Readings

When using volume, readings are given in arbitrary units specified in P051.

The default is 100, which gives a reading in percent of total. Use whatever units you want here. If the value will be too large for the 4-digit LCD, use a larger unit.

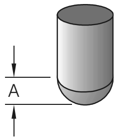
### Example:

If a wet well has a maximum capacity of 250,000 liters, you would use the value 250.0 for P051 and set the reading in 1000s of liters.

## Tank Shape and Dimensions

There are many common tank shapes to select from. (See P050. If possible, use one of these.) Each tank shape uses the Empty distance (P006) in its calculations of volume.

Some tank shapes also require extra dimensions to calculate the volumes. Do not estimate these values, they must be correct to ensure the accuracy of your volume calculations.




To configure volume for a tank with a half-sphere bottom:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P050 | 1 | 4 | selects the correct tank shape |
| P051 | 1 | 100 | sets maximum volume at 100 (percent) |
| P052 | 1 | 1.3 | sets **A** to 1.3m |

**Notes:**
- The default reading changes to a range from 0 to 100 (the value in P051).
- Empty (P006) is still measured to the bottom of the tank, not the top of **A.**

Volume

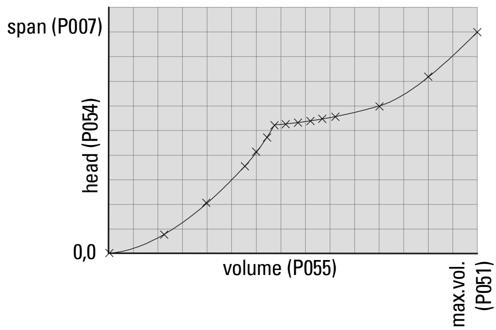
# Characterization Chart

If you cannot use a pre-defined tank, use one of the universal tank shapes and program the characterization curve, sometimes called a linearization table.

1. Plot a volume to height chart. Usually a tank supplier will provide this chart. However, if you have a custom-built wet well, you will need access to complete drawings of the well or accurate measurements.
2. Enter the curve values from this chart into P054 and P055.
3. Ensure extra points are added around sharp transitions in the wet well volume such as steps in the well wall.

**Note:** The end points in the curve are 0,0 (fixed) and the point defined by P007–Span and P051–Maximum Volume.

### Example Chart



| Parameter | Index | Value | Description |
|---|---|---|---|
| P054 | 1 | 0.0 | Determines the head (level) breakpoints at which the volumes are known. |
| | 2 | 0.8 | |
| | 3 | 2.0 | |
| | 4 | 3.5 | |
| | 5 | 4.1 | |
| | 6 | 4.7 | |
| | 7 | 5.1 | |
| | 8 | 5.2 | |
| | 9 | 5.3 | |
| | 10 | 5.4 | |
| | 11 | 5.5 | |
| | 12 | 5.6 | |
| | 13 | 6.0 | |
| | 14 | 7.2 | |
| | 15 | 9.0 | |
| P055 | 1 | 0.0 | Determines the volumes which correspond to the level breakpoints. The universal calculations interpret between the breakpoints to produce an accurate model of the volume at all level readings.<br><br>Settings<br>P050 = 9 for linear approximation<br>P050 = 10 for curved approximation<br><br>Linear approximation uses a linear algorithm, curved approximation uses a cubic spline algorithm. |
| | 2 | 2.1 | |
| | 3 | 4.0 | |
| | 4 | 5.6 | |
| | 5 | 5.9 | |
| | 6 | 6.3 | |
| | 7 | 6.7 | |
| | 8 | 7.1 | |
| | 9 | 7.8 | |
| | 10 | 8.2 | |
| | 11 | 8.8 | |
| | 12 | 9.2 | |
| | 13 | 10.9 | |
| | 14 | 12.0 | |
| | 15 | 14.0 | |

# Alarms

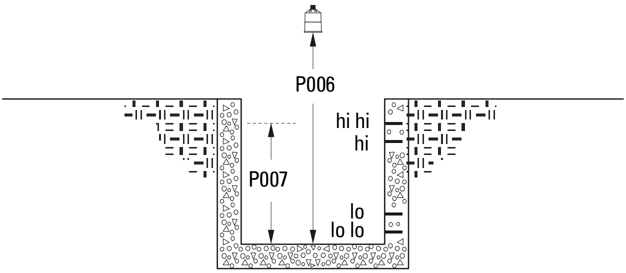
## Level

The level alarm is the most common. Use this alarm to warn when your process is in danger of being upset due to high or low levels.

Generally, the four alarms used are Hi, Hi Hi, Lo, and Lo Lo. There are also 3Hi and 3Lo handled by the overflow and underflow alarms. See *Handling Flow Events* on page 114.

These alarms can also be handled by alternate technologies such as floats or capacitance switches for better backup reliability. For more information on using alternate technologies as backup devices see *Discrete Input Example* on page 115.

### Set the Common Parameters




**Prerequisite:** Substitute the details of your application for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

| Parameter | Index[1] | Value | Description |
|---|---|---|---|
| P001 | G | 1 | Operation = level |
| P002 | G | 1 | Material = liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | G | 1.8 | Empty = 1.8 m |
| P007 | G | 1.4 | Span = 1.4 m |

1. This example assumes a base, single measurement, unit. If your SITRANS LUC500 has optional dual point software installed then some parameters are indexed by two.

# Setting Simple Level Alarms

To set relay 5 to a standard level alarm (HiHi, Hi, Lo, LoLo):

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 1 | • Set P111, indexed to relay, to the value **1** for level alarm<br>• Press UNIT to display the Auxiliary Function symbol<br>• Press ARROWs as required to scroll to the alarm designation (▲▲, ▲, ▼, or ▼▼)<br>• Press ENTER to enter the value. |
| P112 | 5 | 1.2 m | • Set the ON setpoint |
| P113 | 5 | 1.15 m | • Set the OFF setpoint |

**Available designations:**

| Alarm | Designation |
|---|---|
| Hi Hi | ▲▲ |
| Hi | ▲ |
| Lo | ▼ |
| Lo Lo | ▼▼ |

# Rate

Rate alarms can trigger an alarm if the vessel is filling/emptying too quickly.

### Setting a Filling Rate Alarm

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 4 | These settings trip the alarm when the reservoir is filling faster than 1 m per minute and reset it at 0.9 m per minute. |
| P112 | 5 | 1m | |
| P113 | 5 | 0.9m | |

### Setting an Emptying Rate Alarm

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 4 | These settings trip the alarm when the reservoir is emptying faster than 10% of span per minute and reset the alarm when emptying falls to 5%. |
| P112 | 5 | -10% | |
| P113 | 5 | -5% | |

# Bounded Range

Detect when the level is inside or outside of the range. By using a bounded range alarm you can effectively put two level alarms (high and low) on one relay.

### Setting an Out of Bounds Alarm

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 3 | These settings<br>- trip alarm above 1.35 m and below 0.25 m<br>- reset alarm below 1.25 m and above 0.35 m |
| P112 | 5 | 1.3 | |
| P113 | 5 | 0.3 | |
| P116 | 5 | 0.05 | |

### Setting an In Bounds Alarm

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 2 | These settings<br>- trip alarm below 1.25 m and above 0.35 m<br>- reset alarm above 1.35 m and below 0.25 m |
| P112 | 5 | 1.3 | |
| P113 | 5 | 0.3 | |
| P116 | 5 | 0.05 | |

# Pump Efficiency

Pumped efficiency is calculated on the draw down of the application. The SITRANS LUC500 assumes that the inflow to the system is constant and compares the resultant draw down of the wet well with the rated capacity of the pump. If you are using volume, take the rated capacity of the pump from the pump's documentation. If you do not know the pump's rated capacity, follow the steps in Determining a Pump's Rated Capacity, described below.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 8 | alarm on pump efficiency event |
| P180 | 2 | 80 | % of P183 to tag a pump efficiency problem |
| P181 | 2 | 180 | time to calculate pumped efficiency |
| P183 | 2 | 3 | 3 m per minute rated capacity |
| P185 | 2 | 2 | set action to alarm and pump removal |

## Determining a Pump's Rated Capacity

When using level to test a pump's efficiency it is difficult to estimate the draw down rate from the rated volume of the pump. Instead, allow the wet well to fill at least five times and check P182–Pump Measured Capacity to find the average value.

P182 is updated every time a pump down cycle is finished, so do not record the value until the OFF setpoint (P113) is reached. P182 will hold its value until the next time the pump is run. Note that with multiple pumps in an alternate duty assist (lead / lag) cycle the pump you are tracking probably will not run every time the wet well is pumped out.

# Time of Day

Trips an alarm relay at the same time, and for the same duration, every day.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 9 | alarm on time of day |
| P146 | 5 | 14:30 | set for 2:30 p.m. every day |
| P114 | 5 | 5 | set to alarm for five minutes |

# Cable Fault

Activates an alarm if transducer cable circuit enters a shorted or opened state.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 7 | alarm on transducer cable fault |
| P110 | 5 | 1 | alarm on transducer 1 |

# Temperature

Activates an alarm when the temperature reaches the ON setpoint P112. This alarm uses the same setpoint parameters as the level alarms (P112 and P113). With P112 and P113, you can set a high alarm (P112>P113) or a low alarm (P112<P113).

A high alarm:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 5 | alarm on temperature |
| P112 | 5 | 45 | ON setpoint at +45 °C |
| P113 | 5 | 43 | OFF setpoint at +43 °C |
| P110 | 5 | 1 | take the temperature reading from transducer one |

The temperature source can be the temperature sensor built into the transducer or an external TS-3, as set by P660.

# Pump Failure

Activates an alarm when any pump interlock shows a failure. The setpoint is the state of P510–Pump Failed Status. When that parameter is set to **1** on any index the pump failure alarm is activated. The alarm is reset when the status of P510 is reset. See *Discrete Inputs* on page 53 for details.

# Power Failure

Activates an alarm when a discrete input detects a power failure. The power mains to the pumps are cut off but the SITRANS LUC500 is still running. See *Discrete Inputs* on page 53 for details.

# Loss of Echo (LOE)

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 6 | These settings trip the alarm when 0.5 minutes (30 seconds) pass without a valid echo being detected. |
| P070 | G | 0.5 | |

# Clock Failure

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 10 | Triggers an alarm on relay 5 if the clock fails. |

# Trigger Alarms

When a selected parameter value reaches a specified setpoint, the SITRANS LUC500 will initiate an action via the alarm and event trigger subsystem. This trigger may be used to record the occurrence of an event, initiate data communications, or log monitored data when an event occurs. It can also operate an on-board relay based on the triggered event to activate additional alarm or control equipment. Up to 32 different triggers can be set, each tracking a different variable. See page 74 for more information on setting a trigger.

When Relay Function, P111=66 (Trigger), P110 identifies the trigger number the relay operation is based. P111 must be set to **66** before the trigger number (P110) can be set.

Then, the relay specified will follow the state of P424 (Trigger State). If P424=0, the relay is negated; if P424=1, the relay is asserted.

Example: To set Relay 3 based on status of Discrete Input 5:

Trigger 1 based on Discrete Input 5 status

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 1 | 275 | Defines Trigger 1 as based on a Scaled Discrete Input (P275) |
| P421 | 1 | 5 | Identifies trigger as based on DI#5 |
| P422 | 1 | 1 | Sets the trigger to be asserted when the discrete input status = 1 |
| P423 | 1 | 0 | Sets the trigger to be negated when the discrete input status = 0 |

Relay 3 based on Trigger 1 status

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 3 | 66 | Sets relay 3 operation to be based on an Alarm/ Event trigger |
| P110 | 3 | 1 | Relay 3 alarm event Trigger Number = 1 |

Example: To set Relay 5 based on status of Discrete Input Pulse Count.

Trigger 2 based on Discrete Inputs 7 Pulses

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 2 | 275 | Defines Trigger 2 as based on a Scaled Discrete Input (P275) |
| P421 | 2 | 7 | Identifies trigger as based on DI#7 |
| P422 | 2 | 5000 | Sets the trigger to be asserted when the P275 count = 5000 |
| P423 | 2 | 0 | Not used - To reset the pulse trigger, set P275=0 |

Relay 5 based on Trigger 2 pulse total

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 66 | Sets relay 5 operation to be based on an Alarm/ Event trigger |
| P110 | 5 | 2 | Relay 5 alarm event Trigger Number = 2 |

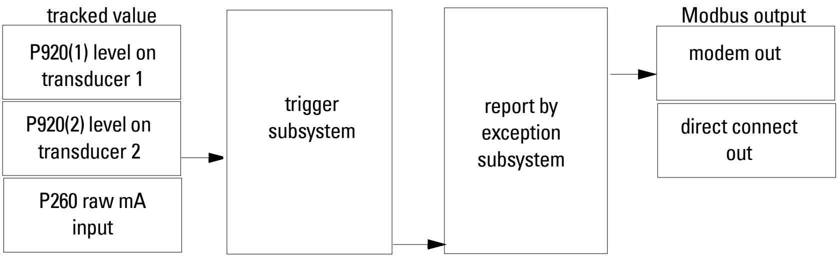
# Watchdog Relay

If P111=67, it will assign the specified relay as a Watchdog Relay. The watchdog relay will toggle on and off at a rate set by the Duration and Interval setpoints defined in P114 and P115. The watchdog relay acts as a "heartbeat", providing output to a PLC verifying that the SITRANS LUC500 is powered and in RUN mode.

# Report by Exception



Use report by exception to have the SITRANS LUC500 alert a SCADA system or HMI to a defined event. These alerts can be sent through a modem or a direct RS-232 or RS-485 connection using the built-in Modbus protocol.




Relays are not affected by the trigger subsystem except when specifically programmed as a trigger alarm. See *Relays* on page 49 for details on programming relays.

When reporting an exception the SITRANS LUC500 can assume the role of a Modbus master or a Modbus slave.

## Reporting as a Modbus Master

When the SITRANS LUC500 contacts a remote system and initiates communication it is acting as a Modbus master. The following describes how a report gets generated and sent when the SITRANS LUC500 is configured as a Modbus master.

1. **The watched variable passes the trigger setpoint:** P920–Reading. (*Setting a Trigger* on page 74).
2. **A trigger is generated:** Trigger number five.
3. **The trigger then initiates any related reporting (or data logging) events:** Report number three. (*Programming the Report* on page 74).
4. **The report dials the modem, if required, to make the connection:** A modem connected through port 2. (*Connection* on page 77).
5. **The SITRANS LUC500 sends the report as a Modbus master:** A remote SCADA system acting as a slave on a specific modem.

In this configuration it is critical to have the dialled system set as a Modbus slave because a Modbus master will ignore the commands of another Modbus master. For example, to set port two (terminal block) the SITRANS LUC500 as a Modbus master for sending reports:

### Direct Connection

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 5 | Sets port 2 as Modbus RTU master |

### Modem Connection

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 2 to 5 | Any Modbus protocol |
| P783 | 2 | 5 | Overrides P770 for the duration of the modem connection |

See the SCADA system documentation on configuring communications.

# Reporting as a Modbus Slave

Report by Exception

When the SITRANS LUC500 contacts a remote system and waits for communication it is acting as a Modbus slave. The following describes how a report gets generated and sent when the SITRANS LUC500 is configured as a Modbus slave.

1. **The watched variable passes the trigger setpoint**
   P920–Reading (*Setting a Trigger* on page 74).
2. **A trigger is generated**
   Trigger number five.
3. **The trigger then initiates any related reporting (or data logging) events**
   Report number three (*Programming the Report* on page 74).
4. **The report dials the modem, if required, to make the connection**
   A modem connected through port 2 (*Connection* on page 77).
5. **The SITRANS LUC500 waits for the Modbus master to request and clear the report**
   A remote SCADA system configured to react to a connection by scanning the reports on the SITRANS LUC500, pulling any existing reports, and then clearing them. In this configuration it is critical to have the dialled system set as a Modbus master which can detect the dial-up connection so that it knows when to request the report data.
   For example, to set port two (terminal block) the SITRANS LUC500 as a Modbus slave for sending reports:

### Direct Connection

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 3 | Sets port 2 as Modbus RTU slave |

### Modem Connection

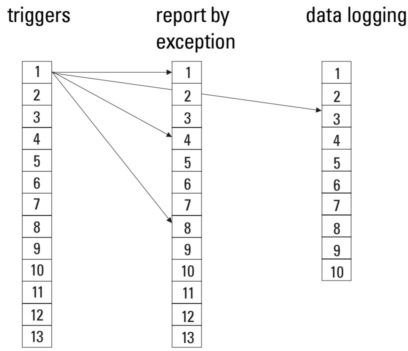
| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 2 to 5 | Any Modbus protocol |
| P783 | 2 | 3 | Overrides P770 for the duration of the modem connection |

See the SCADA system documentation on configuring communications.

# Setting a Trigger

A trigger is required to create the event that is reported. Up to 32 different triggers can be set, each tracking a different variable.

You must configure at least one trigger to initiate a report by exception. One trigger can also initiate multiple actions, both reports and data log operations.




To set trigger number five to generate an event when the level reaches 1.0 m, do the following:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 5 | 920 | Sets a trigger to watch P920–Reading and activate a trigger when the parameter value rises past 1.0. The trigger is reset when the value falls below 0.9. |
| P421 | 5 | 1 | |
| P422 | 5 | 1.0 | |
| P423 | 5 | 0.9 | |

Trigger states are reported in P424, P428, and P429. P424 provides single trigger access by individual trigger index. P428 (Trigger Status Low) and P429 (Trigger Status High) show the status of multiple triggers using binary coded hexadecimal format. P428 represents triggers 1 to 16, and P429 represents triggers 17 to 32.

For example, if triggers 1, 2,5, 15, and 29 are active:

P428 = 4013 (binary equivalent for triggers 1 to 16 = 0100 0000 0001 0011)
P429 = 1000 (binary equivalent for triggers 17 to 32 = 0001 0000 0000 0000)

**Note:** If you are watching a global parameter (one with no index) then P421 must be set to 1.

# Programming the Report

For example, to define report number three to issue when trigger number 5 is activated:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P470 | G | 1 | Sets the SITRANS LUC500 to unit id **1** |
| P471 | G | 2 | Communicates through port 2, the terminal block |
| P481 | 3 | 920 | Reports P920 |
| P482 | 3 | 1 | Reports transducer 1 |
| P483 | 3 | 12 | Report 2 decimal places and force secondary index of 1 |
| P484 | 3 | 5 | Uses trigger #5 to generate exception |
| P485 | 3 | 1 | Reports on trigger activation |

When issued, this report will be sent out through communications port 2, the RS-232 port on the terminal block. That port can be connected directly to a Modbus slave device, or to a modem.

## Typical Reports

You can configure the SITRANS LUC500 to report on any parameter. Typical parameters to watch are:

| Parameter to watch (P420) | Values |
|---|---|
| P169–Flow Condition | 0 – normal operation<br>1 – overflow state<br>2 – underflow state |
| P186–Pump Low Efficiency Counter | Shows number of times pump has failed to meet the efficiency threshold |
| P203–mA Output Value / Transducer | 0 to 22 – Current mA output |
| P254–Scaled mA Input Value | 0 to 9999 – Current mA input after scaling |
| P275–Scaled Discrete Input Value | Shows current value of discrete input, values vary by DI function |
| P452–Number of Entries | 0 to 5000 – Current number of log entries |
| P453–Log Status | 0 – inactive / full<br>1 – active, trigger activated<br>2 – active, trigger negated |
| P510–Pump Failed Status | 0 – normal<br>1 – fault |
| P515–Pump Remote Control Status | 0 – local<br>1 – remote |
| P519–Power Failure Status | 0 – normal<br>1 – power failure |
| P520–Pump Available | 0 – not available<br>1 – available |
| P664–Temperature | Current temperature measured by transducer |
| P707–Rate Value | Current rate of material level change |
| P708–Volume Rate Display | Current rate of material volume change |
| P805–Echo Confidence | Confidence value of short:long shots |
| P806–Echo Strength | Strength of primary echo |
| P911–mA Output Value | 0 to 25 mA |
| P914–mA Input Value | 0 to 24 mA |
| P920–Reading Measurement | Value of the current reading |
| P921–Material Measurement | Level of material |
| P922–Space Measurement | Distance from material to P007–Span |
| P923–Distance Measurement | Distance from material to transducer face |
| P924–Volume Measurement | Current volume (if used) |
| P925–Flow Measurement | Current OCM flow (if used) |
| P926–Head Measurement | Current OCM head (if used) |
| P927–Distance Measurement | As P923 but allows percent |

# Report on Discrete Input

Before configuring the report you must configure the discrete input. See *Discrete Inputs* on page 53.

**To configure trigger 24 to use discrete input six:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 24 | 275 | Sets a trigger to watch P275 – Scaled Discrete Input Value and activate a trigger when the parameter value rises past 0.9. The trigger is reset when the value falls below 0.1. |
| P421 | 24 | 6 | |
| P422 | 24 | 0.9 | |
| P423 | 24 | 0.1 | |

The parameter P275 reports 1 or 0 but the trigger doesn't activate until the value **passes** the setpoint. So setpoint values of 1.0 and 0.0 will not work.

Discrete inputs 7 and 8 can also be configured as pulse counters or frequency inputs. When set up as these types of input they then have a range of values from 0 to 9999 and can activate a trigger based on other setpoints.

# Modbus Communications

To use report by exception you must have another system (Modbus master or slave) available to receive the data from the SITRANS LUC500. This system must be configured to accept multiple register writes (Modbus function code 16).

To configure the SITRANS LUC500 as a slave for incoming calls but as a master for outgoing calls use these parameters:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 3 | Modbus RTU slave for incoming calls |
| P783 | 2 | 5 | Modbus RTU master for outgoing calls |

**Note:** The SITRANS LUC500 will not interrupt a slave session to issue a report when communications is configured through a modem (P778=0).

# Modbus Registers

The information sent in a report is held in registers R49250 to R49259. Set your SCADA system to expect this data when a report is generated.

| Register | Parameter | Description |
|---|---|---|
| R49250 | P470 | SITRANS LUC500 identifier (set to 0 to reset report) |
| R49251 | P484 | Report being sent |
| R49252 | P485 | Trigger state which caused the report |
| R49253 | N/A | Year |
| R49254 | N/A | Month |
| R49255 | N/A | Day |
| R49256 | N/A | Hour |
| R49257 | N/A | Minute |
| R49258 | N/A | Second |
| R49259 | P481, P482, P483 | Reported value |

See *Communications* on page 120 for details on the Modbus register map.

# Resetting the Report

SITRANS LUC500 as Modbus Master: The SITRANS LUC500 resets the report after it is sent to the remote slave.

SITRANS LUC500 as Slave: The remote master must write a zero (0) to R49250.

# Connection

Different communications ports can act as independent master and slave devices. For example, if you have an option card installed, which gives you the RS-485 connection, then you can have port 2 (RS-232) act as a Modbus master for reporting exceptions and still use port 3 (RS-485) as a Modbus slave connected to a SCADA system.



## Direct Connection

See *Installation* and *Communications* sections for details on directly connecting the SITRANS LUC500 to a Modbus device.

## Dial Out

The SITRANS LUC500 can act as either a Modbus master or slave when connected through a modem. This allows the SITRANS LUC500 to report exceptions to a Modbus slave system and also provides data as a slave when queried by a remote master.

**First, set the SITRANS LUC500 up to communicate with the correct protocol:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 2 | Modbus ASCII unsolicited slave |
| | | 3 | Modbus RTU unsolicited slave |
| | | 4 | Modbus ASCII master |
| | | 5 | Modbus RTU master |

**Then, set up the common modem parameters:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P772 | 2 | 9.6 | Data rate of 9600 baud |
| P773 | 2 | 0 | No parity, common setting |
| P774 | 2 | 8 | 8 data bits, common setting |
| P775 | 2 | 1 | 1 stop bit, common setting |
| P776 | 2 | 0 | No hardware flow control |
| P777 | 2 | 0 | No **key up** delay |
| P778 | 2 | 1 | Communicate through a modem |
| P779 | 2 | 30 | Keep connection open for 30 seconds of silence, then hang up |
| P782 | 2 | 0 | Index parameter values globally; see *Communications* for details |

Report by Exception

**To use phone number 1 to call a Modbus slave device:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P783 | 1 | 5 | When connecting, act as a Modbus master |
| P784 | 1 | 1 | Use tone dialling |
| P785 | 1 | 18005551212 | Dial 1-800-555-1212 |
| P786 | G | 3 | Try each number three times before moving on to the next one |
| P787 | G | 2 | Cycle through the numbers twice before giving up |
| P788 | G | 5 | Wait 5 seconds between dialling attempts (P786) |
| P789 | G | 45 | Wait 45 seconds before timing out the dialling attempt |

**To define the communications once a connection is established:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P473 | G | 247 | Send data to node 247 (change to suit) |
| P474 | G | 1500 | Start data at R41,500 |
| P475 | G | 3 | Try sending data 3 times |
| P476 | G | 3000 | Wait 3 seconds for timeout |

**Notes:**

- To enable only one dial out telephone number, set P786 = 9999, and P787 = 0.
- You can define up to eight phone numbers in P785.

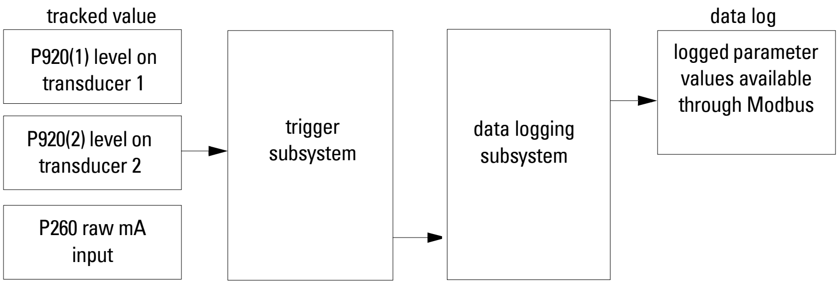
# Polling for an Exception Report

The SITRANS LUC500 can also act as a simple slave device. For details see *Communications* on page 120.

# Data Logging

Use data logging to keep track of a parameter value on regular intervals or on trigger events. Up to 10 data logs can be configured and each log can hold up to 5000 entries.

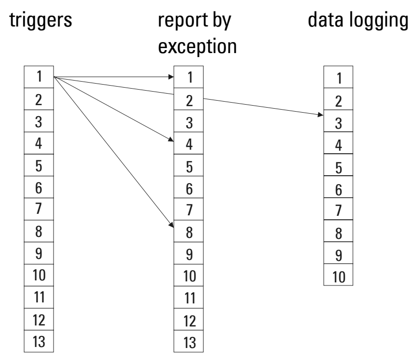
**When started with a trigger, data logging proceeds like this:**




# Setting a Trigger

A trigger is required to create the event that is reported. Up to 32 different triggers can be set, each tracking a different variable.

You must configure at least one trigger to initiate a report . One trigger can also initiate multiple actions, both reports and data log operations.




**Set trigger number five to generate an event when the level reaches 1.0 m:**

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 5 | 920 | Sets a trigger to watch P920–Reading and activate a trigger when the parameter value rises past 1.0. The trigger is reset when the value falls below 0.9. |
| P421 | 5 | 1 | |
| P422 | 5 | 1.0 | |
| P423 | 5 | 0.9 | |

Trigger states are reported in P424, P428, and P429. P424 provides single trigger access by individual trigger index. P428 (Trigger Status Low) and P429 (Trigger Status High) show the status of multiple triggers using binary coded hexadecimal format. P428 represents triggers 1 to 16, and P429 represents triggers 17 to 32.

For example, if triggers 1, 2,5, 15, and 29 are active:

P428 = 4013 (binary equivalent for triggers 1 to 16 = 0100 0000 0001 0011)
P429 = 1000 (binary equivalent for triggers 17 to 32 = 0001 0000 0000 0000)

**Note:** If you are watching a global parameter (one with no index values) then P421 must be set to 1.

## Periodic Trigger

To set trigger number two to trip periodically:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 2 | 009 | Sets a trigger to watch P009–Time and activate a trigger every hour. This trigger value is reported in P424. |
| P421 | 2 | 1 | |
| P422 | 2 | 00:00 | |
| P423 | 2 | 01:00 | |

This will set up a log that can run unattended for over 200 days before requiring purging. A quarterly schedule for pulling data from a remote system, such as a remote OCM flow monitor, ensures that no data is lost. If your data can be averaged over a longer period you can increase P423 to 2 hours and wait an entire year before collecting the data.

# Logging the Data

Once the trigger system is set up, you must define what data will be logged when the event is triggered. To track the measured level on transducer one in data log three:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P440 | G | 1 | Enables data logging |
| P441 | 3 | 920 | Tracks parameter 920 |
| P442 | 3 | 1 | Tracks transducer 1 (primary index) |
| P443 | 3 | 1 | Store the instantaneous value |
| P444 | 3 | 2 | Use a fill and stop log |
| P445 | 3 | 2 | Use trigger #2 to store data |
| P446 | 3 | 1 | Store data when trigger is initially tripped |



## Variable Rate Data Logging

The SITRANS LUC500 can log data at one rate during normal conditions, and a different rate during unusual conditions. P425 enables an event-based trigger to switch between two different logging rates. Enter the trigger index number of the alarm to be used.

P426 and P427 define the periodic trigger rates when the trigger specified by P425 is unasserted and asserted. These periodic trigger rates will be applied when P420=425 (Rate Switch). P422 will still specify the time when the periodic trigger is to start, but P423 will become read-only displaying the current periodic rate.

Example: The SITRANS LUC500 is configured for an OCM application. If the head exceeds 20 cm, the data logging system should log the flow every 30 seconds, until the level drops below 18 cm, when a logging rate of 2 minutes will occur:

Set an alarm and event trigger based on P926 (Head)

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 1 | 926 (head) | Sets the parameter to be monitored |
| P421 | 1 | 1 | Identify Head source from Transducer 1 |
| P422 | 1 | 20 | Level for more frequent data logging to occur |
| P423 | 1 | 18 | Level for less frequent data logging to occur |

Set a variable rate periodic trigger:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P420 | 2 | 425 | Trigger 2 is Variable Rate Switch parameter (P425) |
| P421 | 2 | 1 | Not used (Primary index not required) |
| P422 | 2 | 00:00:00 | Set On setpoint to Start Time |
| P423 | 2 | Read-only | Reports logging rate in use |
| P425 | 2 | 1 | Switch logging rates on Trigger 1 (Head) |
| P426 | 2 | 00:02:00 | Log every 2 minutes when Head trigger is OFF |
| P427 | 2 | 00:00:30 | Log every 30 seconds when Head trigger is ON |

Set a data log to record flowrate at the current logging rate:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P440 | 1 | 1 | Enables data logging |
| P441 | 1 | 925 | Logs current value of P925 (Flow Rate) |
| P442 | 1 | 1 | Identifies Flow source from Transducer 1 |
| P443 | 1 | 1 | Stores the instantaneous value |
| P444 | 1 | 1 | Use a circular log |
| P445 | 1 | 2 | Log data based on Trigger 2 (at the rate held in P423) |
| P446 | 1 | 1 | Store data when trigger is initially tripped |

## Results

Once the triggers are set up the data will be logged in the SITRANS LUC500 RAM. This RAM has battery backup in case of power outage. If long power outages are expected ensure that your battery is changed often to reduce the chances of losing data.

Any time the unit is without power or in PROGRAM mode, values are not logged. This can result in gaps in the data log time stamps or unusual values on averaged logs.

# Reading Values through Modbus

To read the data logs, you must program your Modbus master device to write requests into the handshaking area and then read the results.

See *Communications* section for details on using Modbus communications.

# Data Log Status Information

Each log has associated status information that shows how many entries are in the log so that you can use the handshaking area to pull them out.

**Each log has four pieces of data on it:**

| Entry | Log | Registers |
|---|---|---|
| value | 1 | R49500, R49501 |
| time stamp | 1 | R49502, R49503 |
| trigger state | 1 | R49504 |
| number of entries | 1 | R49505 |
| value | 2 | R49506, R49507 |
| time stamp | 2 | R49508, R49509 |
| trigger state | 2 | R49510 |
| number of entries | 2 | R49511 |
| … | … | … |
| value | 10 | R49553, R49554 |
| time stamp | 10 | R49555, R49556 |
| trigger state | 10 | R49557 |
| number of entries | 10 | R49558 |

**To determine the start register for a log, use the formula:**

((Log number * 6) – 6) + 49,500 = start register

1. Read the number of entries in the appropriate log register (see table above).
2. Write the requested log number and entry number:

| Register | Value | Description |
|---|---|---|
| R49700 | 3 | Requests log 3 |
| R49701 | 857 | Requests log entry 857 |

3. Read the logged value from registers R49702 and R49703 in UINT32 format.
4. Loop through steps 2 and 3 until all of the entries are read.

# Reading Values through Parameters

Arbitrary logged values are only available with Modbus communications. To read them with a SCADA or HMI system, see *Logging the Data* on page 80.

You can read some averages and maximum and minimum values through the LCD or Dolphin Plus.

## Reading the Last Value

To read the most recent value added to the data log view P450. To find out when that data log was taken, view P451. The value shown is the time of the trigger, the date portion of the time stamp is not available through the LCD. To get the date value of the time stamp use Modbus communications. See *Communications* section for details.

# Reading an Average

Averages are only available if the trigger for that data log is periodic (P420 = 9). See *Periodic Trigger* on page 80 for more information.

To read an average from the logged values, do the following:

1. Set P454 to the appropriate log value.
2. Set P455 to the average you want:

| Average Calculated On | P455 = |
|---|---|
| current hour | 1 |
| current day | 2 |
| current week | 3 |
| current month | 4 |
| previous hour | 5 |
| previous day | 6 |
| previous week | 7 |
| previous month | 8 |
| previous 60 minutes | 9 |
| previous 24 hours | 10 |

3. View P456 for the current averaged value.
This value is continuously updated when the SITRANS LUC500 is in Run mode. Reading the average will give you the calculated average for that time period. The logging period must be shorter than the averaged period to get a reasonable result.

# Reading the Maximum Logged Value

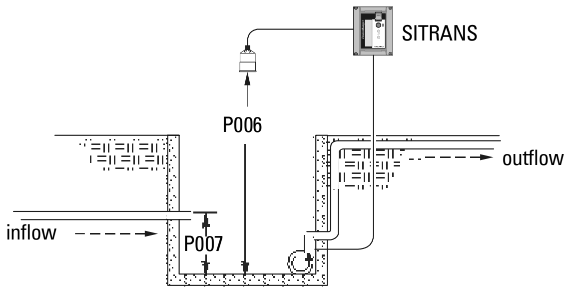
View P458 to see the largest logged value.

# Reading the Minimum Logged Value

View P457 to see the smallest logged value.

# Setting a Pump Down (Wet Well) Group

Sets a group of three pumps to pump down a wet well.




### Set the Common Parameters

**Prerequisite:** Substitute the details of your application for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

| Parameter | Index[1] | Value | Description |
|---|---|---|---|
| P001 | G | 1 | Operation = level |
| P002 | G | 1 | Material = liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | G | 1.8 | Empty = 1.8 m |
| P007 | G | 1.4 | Span = 1.4 m |

1. This example assumes a base, single measurement unit. If your SITRANS LUC500 has optional dual point software installed then some parameters are indexed by two.

### Set Relays to Alternate Duty Assist

| 0 | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 52 | Sets the pump relays (index 1, 2, and 3) to **alternate duty assist**. |
| P111 | 2 | 52 | |
| P111 | 3 | 52 | |

### Set the On Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 1.0 m | Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps. |
| P112 | 2 | 1.1 m | |
| P112 | 3 | 1.2 m | |

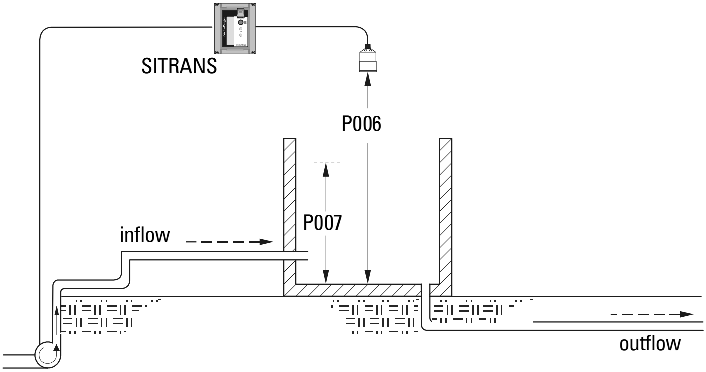
### Set the Off Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 0.5 m | 0 sets all relays at once, including any alarm relays. |

**Note:** Optional parameters found on page 86

# Setting a Pump Up (Reservoir) Group

Sets a group of three pumps to pump up a reservoir.




### Set the Common Parameters

**Prerequisite:** Substitute the details of your application for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

| Parameter | Index[1] | Value | Description |
|---|---|---|---|
| P001 | G | 1 | Operation = level |
| P002 | G | 1 | Material = liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | G | 1.8 | Empty = 1.8 m |
| P007 | G | 1.4 | Span = 1.4 m |

1. This example assumes a base, single measurement, unit. If your SITRANS LUC500 has optional dual point software installed then some parameters are indexed by two.

### Set Relays to Alternate Duty Assist

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 52 | Sets the pump relays (index 1, 2, and 3) to **alternate duty assist**. |
| P111 | 2 | 52 | |
| P111 | 3 | 52 | |

Pump Control

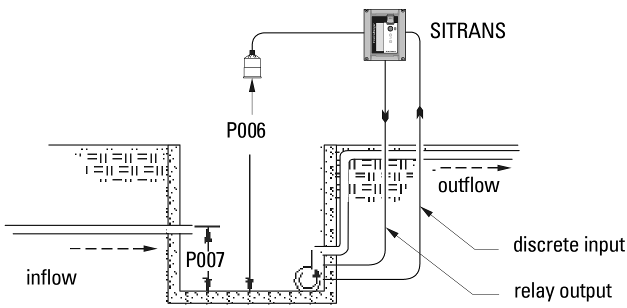
### Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

### Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

# Pump Control Interlocks




| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 52 | Sets the pump relays (index 1, 2, and 3) to **alternate duty assist**. |
| P111 | 2 | 52 | |
| P111 | 3 | 52 | |
| P505 | 1 | 3 | Sets discrete inputs 3, 4, and 5 as the inputs for the pumps attached to relays 1, 2, and 3 respectively. |
| P505 | 2 | 4 | |
| P505 | 3 | 5 | |

These values will ensure that any pump reporting a failure is removed from the pumping rotation. For more information on pump interlocks and discrete inputs, see *Discrete Inputs* on page 53.

See also *Appendix D–Pump Control Reference* on page 309.

# Other Pump Control Algorithms

### Set the Relays to Alternate Duty Backup

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 53 | Sets the pump relays (index 1, 2, and 3) to **alternate duty backup**. |
| P111 | 2 | 53 | |
| P111 | 3 | 53 | |

### Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

### Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

### Set the Relays to Fixed Duty Assist

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 50 | Sets the pump relays (index 1, 2, and 3) to **fixed duty assist**. Multiple pumps can run simultaneously. |
| P111 | 2 | 50 | |
| P111 | 3 | 50 | |

### Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The setpoints remain attached to the pump relays. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

### Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

### Set the Relays to Fixed Duty Backup

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 51 | Sets the pump relays (index 1, 2, and 3) to **fixed duty backup**. Only one pump will ever run at one time. |
| P111 | 2 | 51 | |
| P111 | 3 | 51 | |

### Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The setpoints remain attached to the pump relays. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

## Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

## Set the Relays to Alternate Duty Service

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 54 | Sets the pump relays (index 1, 2, and 3) to **service ratio duty assist**. |
| P111 | 2 | 54 | |
| P111 | 3 | 54 | Sets the ratio to: |
| P122 | 1 | 25 | 25% - pump one |
| P122 | 2 | 50 | 50% - pump two |
| P122 | 3 | 25 | 25% - pump three |

## Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

## Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

## Set the Relays to First In First Out (FIFO) Assist

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 56 | Sets the pump relays (index 1, 2, and 3) to **FIFO duty assist**. |
| P111 | 2 | 56 | |
| P111 | 3 | 56 | |

## Set the Relay ON Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 0.4 m | Sets the three setpoints for the pump relays. The first cycle will use these setpoints. Subsequent cycles rotate the setpoints among the pumps. |
| P112 | 2 | 0.3 m | |
| P112 | 3 | 0.2 m | |

## Set the Relay OFF Setpoints

| Parameter | Index | Value | Description |
|---|---|---|---|
| P113 | 0 | 1.3 m | By using index 0 all five relays are set at the same time, including any alarm relays. Use index 0 with caution. |

See also: *Appendix D–Pump Control Reference* on page 309.

# Optional Pump Controls

## Starting Pumps by Rate of Level Change

| Parameter | Index | Value | Description |
|---|---|---|---|
| P112 | 1 | 1.35 | Starting pumps by rate allows all setpoints to be set higher to save money by pumping from the highest safe level of the wet well.<br><br>Notice that all indexed relays for both P112 and P113 are set to the same levels.<br><br>The pumps will start on 20 second intervals until the rate set in P703 is met. |
| P112 | 2 | 1.35 | |
| P112 | 3 | 1.35 | |
| P113 | 1 | 0.5 m | |
| P113 | 2 | 0.5 m | |
| P113 | 3 | 0.5 m | |
| P121 | 1 | 1 | |
| P121 | 2 | 1 | |
| P121 | 3 | 1 | |
| P132 | G | 20.0 | |

Use this function when there are multiple pumps that should be controlled by rate of level change rather than setpoints. Pumping costs can be less because only the highest ON setpoint needs to be programmed and this results in a lower difference in head to the next wet well which, in turn, results in less energy being used to pump out the well.

After reaching the first ON setpoint, the pumps will start, one by one, until the material level rate of change at the same or greater than the value in:

- P703–Emptying Indicator (pump down applications)
- P702–Filling Indicator (pump up applications)

The delay between pump starts is set by P132–Pump Start Delay.

In Single Point Mode, there is one pump by rate control available that affects all pumps. In Dual Point Mode, a single pump by rate control can be set up for each of the three available level points (if Operation is set for difference, average, or sum P001 = 4, 5, or 10).

**Notes:**
- All pump control relay ON and OFF setpoints must be set to the same value.
- If the level is within 5% of Span (P007) of the OFF setpoint then the next pump is not started.

## Rotating Pumps by Service Ratio

**Prerequisite:** the pump relays must be set to a **service ratio** value (P111 = 54 or 55).

| Parameter | Index | Value | Description |
|---|---|---|---|
| P122 | 1 | 1 | These values will start pump 2 50% of the time and pumps 1 and 3 25% of the time each. |
| P122 | 2 | 2 | |
| P122 | 3 | 1 | |

**Notes:**
- The SITRANS LUC500 will not sacrifice other pumping strategies to ensure that the ratio is held true.
- If the pump relays are set to the same value then the ratio equals 1:1 and all pumps are used equally (preset).

When more than one pump is assigned a Pump Service Ratio value (in any time units) and a pump start is required (Relay Setpoint ON, P112), the pump with the least running hours (with respect to the assigned ratio values) is started. Conversely, when a pump stop is required (Relay Setpoint OFF P113), the pump with the most running hours (as compared to the assigned ratio values), stops.

# Totalizing Pumped Volume

Prerequisite: the volume of the wet well or reservoir must be known.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | G | 7 | Operation = pumped volume |
| P002 | G | 1 | These parameters are as above. |
| P003 | G | 2 | |
| P004 | G | 102 | |
| P005 | G | 1 | |
| P006 | G | 1.8 | |
| P007 | G | 1.4 | |
| P050 | G | 1 | Tank volume is **flat-bottom**. |
| P051 | G | 17.6 | Max volume is 17.6 $m^3$ or 17,600 liters |
| P111 | 1 | 52 | Sets relays 1, 2, and 3 as a pump group using Alternate Duty Assist control. |
| P111 | 2 | 52 | |
| P111 | 3 | 52 | |
| P112 | 1 | 1.0 | Sets the ON setpoints for the pump group. |
| P112 | 2 | 1.2 | |
| P112 | 3 | 1.4 | |
| P113 | 0 | 0.2 | Sets the OFF setpoints for all relays. |

### Run Mode

1. Press to enter RUN mode.
2. Press to display the pumped volume on the totalizer.
3. Press to display the current level in the auxiliary reading area.

# Setting Independent Failsafe Controls

Independent failsafe controls allow you to vary an individual relay from the global failsafe controls programmed in P070 to P072. In the example the global failsafe controls are set to HOLD and relay 5 is set to trigger an alarm bell.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P071 | G | HOLd | Keep level at last known value |
| P129 | 5 | dE | De-energize relay 5, and trigger alarm |

# Setting a Pump to Run On

Sometimes it is important to pump below the normal OFF setpoint. In these cases use P130–Pump Run-On Interval and P131 Pump Run-On Duration to control this event.

In the example the pump connected to relay number 3 is set to pump for an extra 60 seconds every 5 hours.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P130 | G | 5 | Time in hours of run-on interval |
| P131 | 3 | 60 | Run-on for 60 seconds |

**Note:** P130 sets the number of hours between run-on intervals. But, if peak hours are programmed (P140–P145), pump run-on will not occur during the peak hours.

# Setting the Pump Start Delays

The pump start delay ensures that all of the pumps do not start at once to avoid power surges. There are two parameters used here, P132–Pump Start Delay and P133–Pump Power Resumption Delay. The default is 10 seconds but you can increase this if your pumps take longer to spin up.

In the example the delay between pumps is set to 20 seconds and the delay of the first pump is set to 30 seconds.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P132 | 3 | 20 | Wait at least 20 seconds between pump starts |
| P133 | G | 30 | Wait for 30 seconds when power is restored |

# Setting the Pump Exercising Interval

Use pump exercising on slow wet wells or when one pump is outside of the normal duty schedule. See *Appendix D–Pump Control Reference* on page 309 for details on the pump control algorithms.

When the pump remains idle for the number of hours specified, it pumps any liquid in the well down to the OFF setpoint.

In the example pump relay 3 is set to exercise every 48 hours if it has not run due to normal operation.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P134 | 3 | 1 | Set pump exercising on for this relay |
| P114 | 3 | 60 | Run the pump for 60 seconds |
| P115 | 3 | 48 | Run the pump if it has been idle for 48 hours |

# Setting Pump with Float Backup

Use the pump with float backup as a precaution against over-filling or running dry if current measurement system fails. You will configure a high and low level float.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P100 | global | 1 | Wet well 1 setting (see page 52) |
| P558 | 1 | 1 | Discrete Input 1 connected to high-level float. This DI will turn on the pumps if the float asserts a high-level indicator. |
| P559 | 1 | 2 | Discrete Input 2 connected to low-level float. This DI will turn off the pumps if the float asserts a low-level indicator |

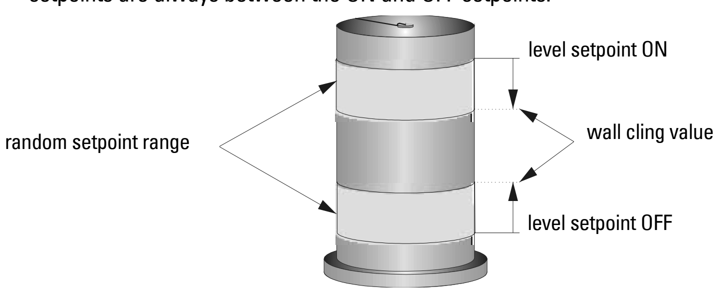
After completing one cycle using the float system, the SITRANS LUC500 will try to use the standard measurement system.

# Reducing Wall Cling

Use the Wall Cling parameter to randomly alter the ON and OFF setpoints over a range. This eliminates the ridge of material that builds up at the setpoint that can give false echoes.

This may increase the number of days between trips to clean the wet well.

In the example a range of 0.5 meters is used to vary the setpoint. The randomly-selected setpoints are always between the ON and OFF setpoints.




| Parameter | Index | Value | Description |
|---|---|---|---|
| P134 | 3 | 1 | Set pump exercising on for this relay |
| P114 | 3 | 60 | Run the pump for 60 seconds |
| P115 | 3 | 48 | Run the pump if it has been idle for 48 hours |

# Grouping Pumps

You can group pumps and use the same pumping algorithm separately on each group. If you specify different pumping algorithms then the pumps are already grouped by algorithm and you do not need to use this parameter. Use this only when four pumps are using the same algorithm and you want to split them into two groups.

Pump Control

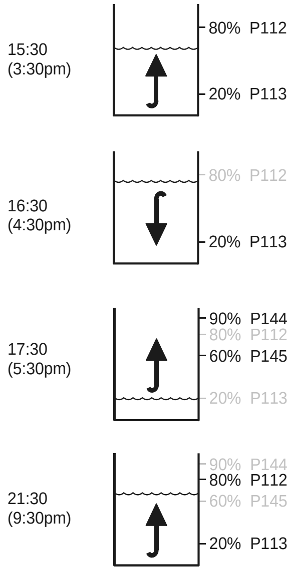
In this example, pumps one and two can operate as a group and pumps three and four can operate as another group.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P137 | 1 | 1 | Groups pumps 1 and 2 |
| P137 | 2 | 1 | |
| P137 | 3 | 2 | Groups pumps 3 and 4 |
| P137 | 4 | 2 | |

# Saving Energy

Pumps can use different setpoints at different times of the day to account for variable energy costs.

The following example illustrates high energy cost usage reduction and/or elimination by using the SITRANS LUC500 Pump Energy Cost Reduction features on a wet well (pump down application).




Normal Operation
Uses the standard ON and OFF setpoints (P112 / P113). Energy cost is at minimum.

Peak Lead time (P143 = 60 minutes)
Pumps down the wet well regardless of the Relay ON Setpoints. This ensures that the wet well starts the high cost period at the pumps' OFF setpoint. Energy cost is at minimum.

Peak Start Time (P141 = 17:30)
Starts using the energy savings setpoints (P144 and P145). Energy cost is at maximum.

Peak End Time (P142 = 21:30)
Returns to normal setpoints (P112 and P113). Energy cost returns to minimum.

Generally, you would cascade the timing of the pump downs so that the wells farthest from the treatment facility would begin first and the entire system would push material through during the low cost period.

**Note:** When the Peak ON Setpoint is not reached, no energy is used during the **high cost** period. If the Peak ON Setpoint is reached, the Wet Well is only pumped down to 60%, thereby minimizing **high cost** energy usage.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P140 | G | 2 | Sets the unit to allow time of day setpoints |
| P141 | 1 | 17:30 | Starts the first high cost period at 5:30 pm |
| P142 | 1 | 21:30 | Ends the first high cost period at 9:30 pm |
| P143 | G | 60 | Sets the pump down to happen 60 minutes before the high cost period |
| P144 | 1 | 90 | Sets the high cost ON setpoint as 90% |
| P145 | 1 | 60 | Sets the high cost OFF setpoint as 60% |
| P148 | G | 3 | Sets discrete input 3 as the override switch |

# Setting Aeration

Use the Aeration Control Relay Function to activate a device based on elapsed time since all pumps have been OFF.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 4 | 62 | Sets relay 4 as aeration |
| P114 | 4 | 10 | Assert the function for 10 minutes |
| P115 | 4 | 6 | Assert the function every 6 hours |

# Setting a Flush Valve

A flush valve is used to stir up sediment on the bottom of the well during pumping so that it doesn't accumulate. The parameters P170 to P173 will control any relays set with P111 = 64–Flush Valve.

Most sets of parameters will work with only one or two changes. However, for these parameters to work, all of them must be set to a value.

In this example the flush valve is connected to relay 4 and the watched pump is on relay 1.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P170 | G | 1 | Watch relay 1 to count pump cycles |
| P171 | G | 3 | Open the flush valve for 3 cycles |
| P172 | G | 10 | Use the flush value every 10 cycles |
| P173 | G | 120 | Open the flush valve for 120 seconds |

# Testing Pump Efficiency

The SITRANS LUC500 can measure pump efficiency by measuring the draw down in the wet well when the pumps start. This method has been proven to be accurate to within 5% of an electromagnetic flow meter for pumped volume calculations.You can monitor your pumps for efficiency and take action if one or more of them have problems.

Below, the pumps are set to trigger an alarm event when they drop below 70% efficiency.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P180 | 1 | 70 | Sets all three pumps to a 70% threshold before a low efficiency event is recorded |
| P180 | 2 | 70 | |
| P180 | 3 | 70 | |
| P181 | G | 120 | Calculates volume over 120 seconds |
| P183 | 1 | 3750 | Sets the rated capacity in liters per minute of the three pumps, assumes that the volume parameters are used |
| P183 | 2 | 3750 | |
| P183 | 3 | 6500 | |
| P184 | 1 | 3 | Takes the action defined below when the third low efficiency event is recorded |
| P184 | 2 | 3 | |
| P184 | 3 | 3 | |
| P185 | 1 | 2 | Trigger alarms and remove pump from duty schedule (P510=1, P512=1) |
| P185 | 2 | 2 | |
| P185 | 3 | 2 | |

## Relay Controlled by Communications

A relay can be controlled directly by a remote system through communications. No other control schemes can be used with a relay configured this way. Communications can be used to force status of some control relays, such as pumps.

Settings:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 65 | Sets relay 5 as controlled by communications |

## Relay Controlled by Time

A relay can be controlled by time setpoints (P114 and P115).

Settings:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 4 | 9 | Sets relay 5 as controlled by time |
| P114 | 4 | 10 | Assert the function for 10 minutes |
| P146 | 4 | 24 | Assert the function every 24 hours |

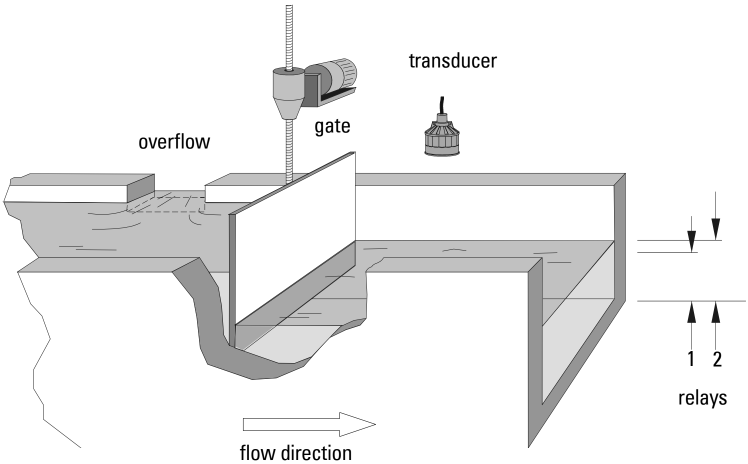
# Tracking Pump Usage

You can find out how much an individual pump has been used by viewing the pump records parameters.

| Information Available | Parameter Access |
|---|---|
| Current RUN time | P309 |
| Total pump hours | P310 |
| Total pump starts | P311 |
| Total pump RUN on occurrences | P312 |

# Gate Control

## Setting a Gate (Penstock) Control




### Set the Common Parameters

**Prerequisite:** Substitute the details of your application for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | G | 1 | Operation = Level |
| P002 | G | 1 | Material = Liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | G | 1.8 | Empty = 1.8 m |
| P007 | G | 1.4 | Span = 1.4 m |

### Set Relay 1 (Open Gate)

Relay 1 is wired to the **open** connections on the gate control. When relay 1 is energized the gate moves up.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 1 | 63 | Sets relay 1 to energize (open gate) when the level is below 45% of the span (0.63 m). The gate will open for 0.1 minute (6 seconds) and this cycle will happen once per 0.02 hours (1 minute, 12 seconds) until the level is above 45%. |
| P112 | 1 | 45% | |
| P113 | 1 | ---- | |
| P114 | 1 | 0.1 | |
| P115 | 1 | 0.02 | |

Gate Control

# Set Relay 2 (Close Gate)

Relay 2 is wired to the **close** connections on the gate control. When relay 2 is energized the gate moves down.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 2 | 63 | Sets relay 2 to energize (close gate) when the level is above 55% of the span (0.77 m). The timing (P114, P115) of relay 2 is set from the relay 1 setpoints. |
| P112 | 2 | 55% | |
| P113 | 2 | ---- | |

**Note:** Care must be taken to adjust P114 and P115 for proper proportional integral (PI) control without overshoot or cycling. P114 is equivalent to proportional band (P). P115 is equivalent to reset (I).

The transducer can also be placed upstream from the gate to control upstream head.

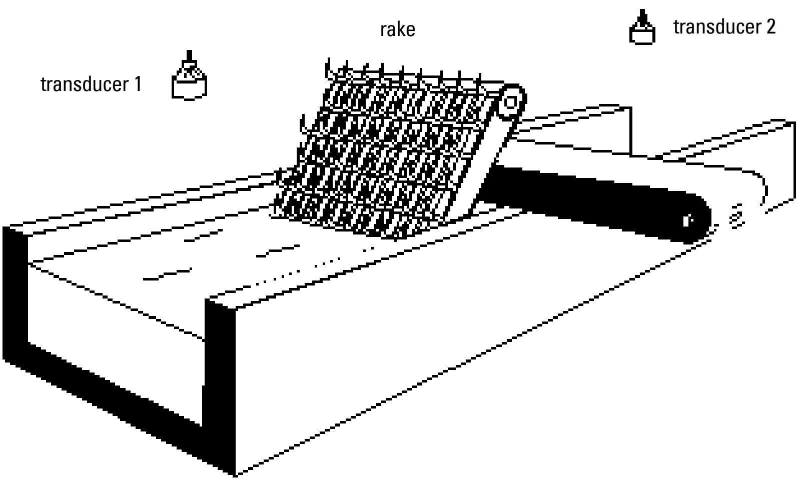
For more information on an OCM Dynamic Zero / Gate Control application, see application guide on our web site at **www.siemens.com/processautomation**.

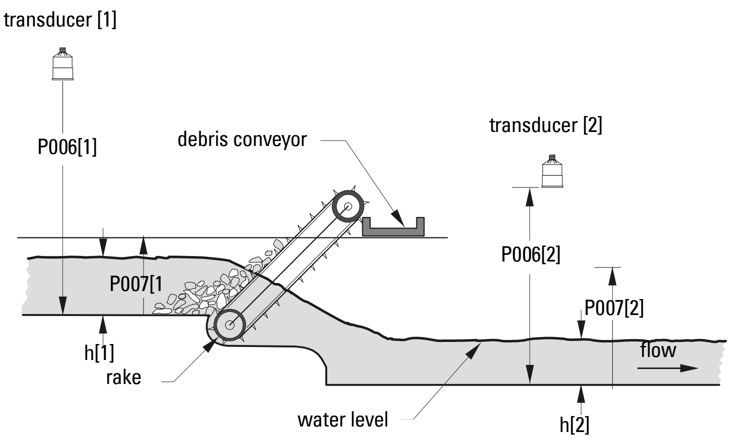
Gate Control

# Rake (Screen) Control

Screens or rakes are mounted on the inflow channel of the wastewater treatment plant to prevent debris from clogging the equipment. When material builds up on the screen a level differential is created with the water level higher in front of the screen than behind it. When this differential reaches the programmed setpoint the SITRANS LUC500 activates a relay to run mechanical rakes to clean the screen and ensure a steady flow into the treatment process.

## Setting a Rake Control




Level difference (point 3) = h[1]–h[2]

# Setting the Common Parameters

**Prerequisite:** Substitute the details of your application for the sample values provided. If you are bench testing the unit, set your test values to be the same as the sample values.

| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | G | 4 | Operation = Differential |
| P002 | G | 1 | Material = liquid |
| P003 | 1,2 | 2 | Maximum Process Speed = medium |
| P004 | 1,2 | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | 1 | 1.8 | Empty = 1.8 m |
| | 2 | 2.2 | Empty = 2.2 m |
| P007 | 1 | 1.4 | Span = 1.4 m |
| | 2 | 1.4 | Span = 1.4 m |

# Set Relay 1 (Operate Rake)

| Parameter | Index | Value | Description |
|---|---|---|---|
| P110 | 1 | 3 | Starts the rake when the difference between the two levels rises above 0.4 m and stop the rake when the difference falls below 0.1 m. |
| P111 | 1 | 50 | |
| P112 | 1 | 0.4 | |
| P113 | 1 | 0.1 | |

# Set Relays 2 to 4 (Level Alarms)

| Parameter | Index | Value | Description |
|---|---|---|---|
| P110 | 2 | 1 | Sets relay 2 as a high level alarm for transducer 1 with an ON setpoint of 1.3 m and an OFF setpoint of 1.2 m. |
| P111 | 2 | 1 | |
| P112 | 2 | 1.3 | |
| P113 | 2 | 1.2 | |
| P110 | 3 | 2 | Sets relay 3 as a low level alarm for transducer 2 with an ON setpoint of 0.2 m and an OFF setpoint of 0.4 m. |
| P111 | 3 | 1 | |
| P112 | 3 | 0.2 | |
| P113 | 3 | 0.4 | |
| P110 | 4 | 3 | Sets relay 4 as a **rake failure** alarm as it uses the differential level point (3) with an ON setpoint of 1.0 m and an OFF setpoint of 0.9 m. |
| P111 | 4 | 1 | |
| P112 | 4 | 1.0 | |
| P113 | 4 | 0.9 | |

# External Totalizers and Flow Samplers

External totalizers are simple counters which count the number of relay clicks produced by the SITRANS LUC500. This information is used to keep track of OCM or pumped volume totals. Note that both of these values are also stored in the SITRANS LUC500 and are available through communications.

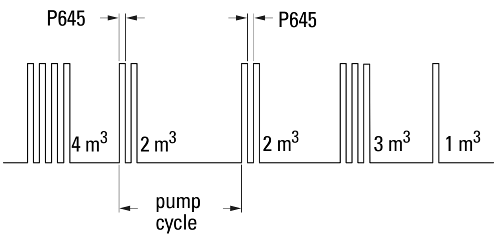
Flow samplers are devices which take a sample of liquid when triggered by a relay click. These samples are used to monitor water quality over time. Flow samplers can be driven by OCM volume or by time depending on the application requirements.



## Relay Contacts

Pumped volume is calculated at the end of the pump cycle. Totalized volume given through a relay set up for totalizer (P111[r]=40) will be given in bursts at this time. Both the open and closed times for the relay contact are provided by P645 and are preset to 0.2 seconds. Partial units are added to the next pump cycle.

### Example




The example shows a relay set up to make 1 contact for every cubic metre ($m^3$) of liquid.

## Totalizer

To set the totalizer to provide relay contact to an external counter, use the following:

| Counter Formula | |
|---|---|
| 1 Contact per $10^{P640}$ units | P640 is preset to **0** so the default number of contacts for a pumped volume cycle is equivalent to the number of volume units. |

### The source of units varies depending on the operation:

| Operation | Units Source Parameter |
|---|---|
| OCM (P001=6) | P604–Maximum Flow, or P608–Flowrate Units |
| Pumped Volume (P001=7) | P051–Max Volume |

# Flow Sampler

## Based on Volume and Time

To trigger a flow sampler relay based on flow use P111[r]=41 and set the other parameters:

| Counter Formula |
| --- |
| 1 Contact per P641 x $10^{P642}$ units |

| Operation | Units Source Parameter |
| --- | --- |
| OCM (P001=6) | P604–Maximum Flow, orP608–Flowrate Units |

By using a mantissa (P641) and an exponent (P642) the relay contacts can be based on a volume other than a multiple of ten.

During periods of low flow, the sampler may be idle for lengths of time. Program P115 to a time interval in hours to drive the sampler. The sampler will operate based on the volume of flow or the time interval, whichever comes first.

## Based on Time

To trigger a flow sampler based on time use P111[r]=60. When controlling a flow sampler by time you also have to set:

| Parameter | Usage |
| --- | --- |
| P114 | Sets the DURATION of the relay contact, usually short |
| P115 | Sets the INTERVAL of the relay contact, usually long |
| P645 | Normally not used, but sets the minimum relay contact |

# Open Channel Monitoring (OCM)

There are four ways of defining an OCM installation depending on your Primary Measuring Device (PMD):

### 1. Dimensional (P600=2,3,6,7)

For some common weir and flume types. PMD dimensions (P602) are entered directly.


- BS-3680 / ISO 1438/1 Thin plate V notch weir on page 104
- BS-3680 / ISO 4359 Rectangular Flume on page 105
- Palmer Bowlus Flume on page 106
- H Flume on page 107


### 2. Exponential (P600=1)

For most other weir and flume types. PMD exponents provided by the manufacturer are entered. Calculate flow using the exponent (P601) and the maximum values (P603 and P604).


- Standard Weirs on page 108
- Parshall Flume on page 109
- Leopold Lagco Flume on page 110
- Cut Throat Flume on page 111


### 3. Universal (P600=4,5)

For other PMDs, the head-to-flow curve can be plotted based on known breakpoints, usually supplied by the PMD manufacturer.


- Typical Flow Characterization on page 111
- Example Flumes on page 112
- Example Weirs on page 112


### 4. Area x Velocity (P600=8,9,10,11)

For channels where the cross-sectional area and velocity are known, the flow can be calculated by multiplying area x velocity.

- round pipe with velocity sensor
- rectangular channel with velocity sensor

For other channels, the head-to-area curve can be plotted based on known breakpoints. Flow is calculated using the head-to-area curve and a velocity input.

- Universal Linear Area Calculation, Area x Velocity
- Universal Cubic Area Calculation, Area x Velocity

Identify the velocity source using P612. See Area x Velocity example on page 113 for more information.

# Set the Common Parameters

These Quick Start parameters are required for all installations.

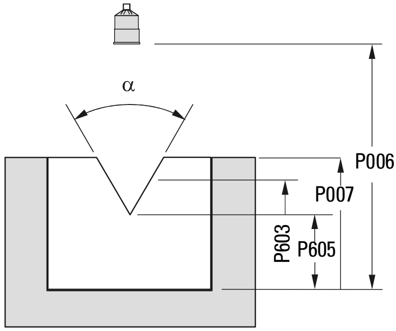
| Parameter | Index | Value | Description |
|---|---|---|---|
| P001 | G | 6 | Operation = OCM |
| P002 | G | 1 | Material = liquid |
| P003 | G | 2 | Maximum Process Speed = medium |
| P004 | G | 102 | Transducer = XPS-10 |
| P005 | G | 1 | Units = meters |
| P006 | G | 1.8 | Empty = 1.8 m |
| P007 | G | 1.0 | Span = 1.4 m |
| P801 | G | 0.8 | Range Extension to avoid LOE |

# Setting Zero Head

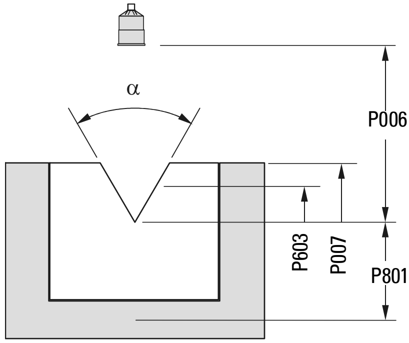
Many PMDs start flowing higher than the traditional empty distance of the application. You can account for the flow in two ways:

1. Use P605 Zero Head to have OCM calculations ignore levels below that value. Possible head = P007 - P605.

**Note:** P603 is preset to P007 and is not updated when P605 is used. Make sure you set P603 to the correct value when using P605.




2. Use P801 Range Extension where the Empty level is set to the bottom of the weir, and above the bottom of the channel. It should be used if the surface monitored can fall past Empty (P006) level in normal operation without reporting an LOE. The value is added to Empty (P006) and can be greater than the range of the transducer.




The examples on the following pages show both methods.

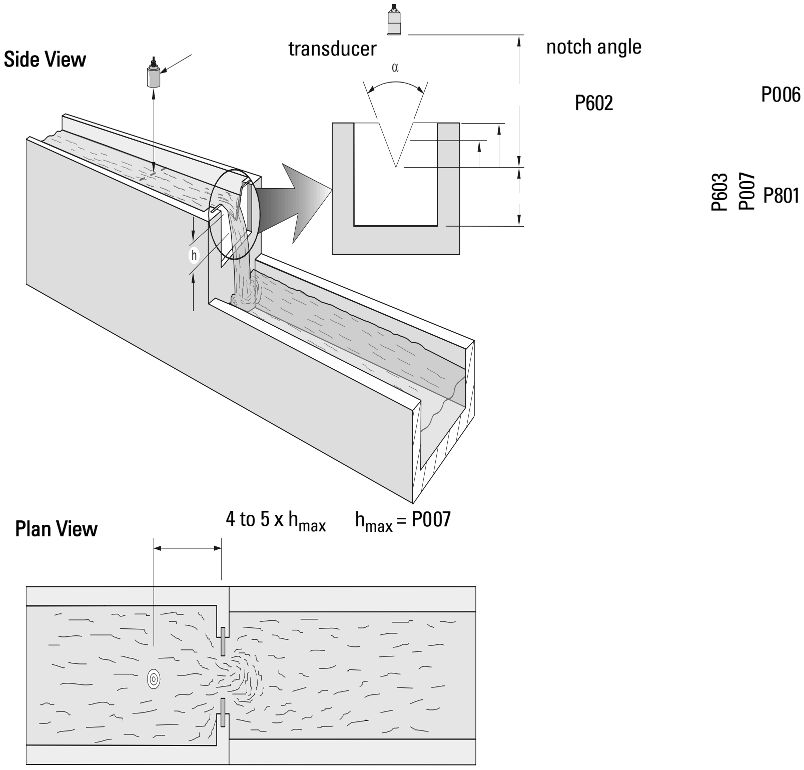
# Setting Totalized Volume

To display the totalized volume on the LCD, use the following parameters:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P737 | G | 2 | Show the eight digit totalizer in the primary display |

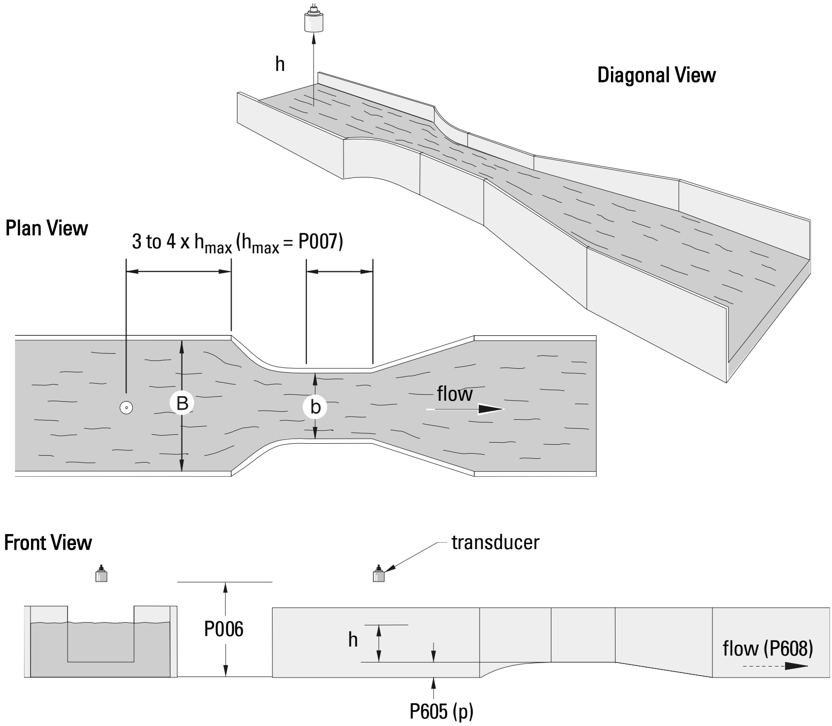
# Direct Support

## BS-3680 / ISO 1438/1 Thin plate V notch weir



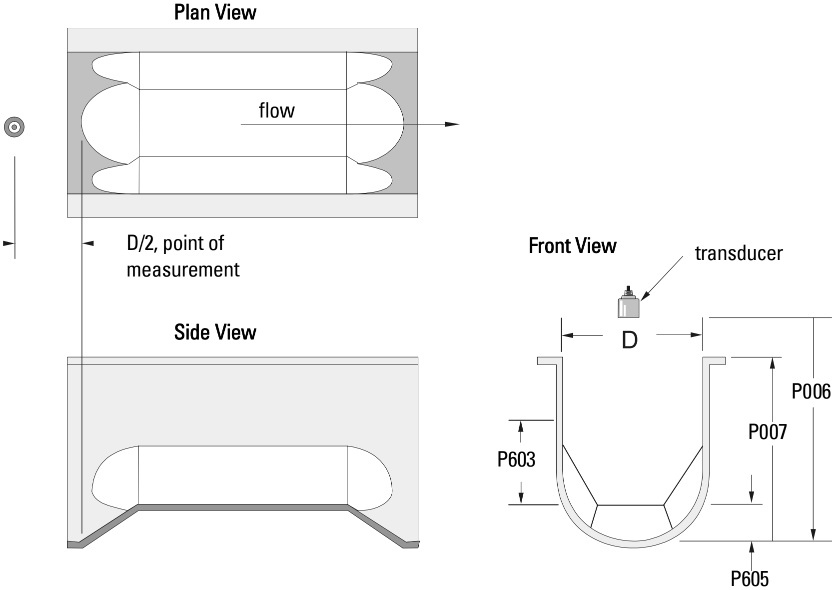

| Parameter | Index | Value |
|---|---|---|
| P600 | G | 7–ISO 1438/1 V Notch Weir |
| P602 | 1 | Notch angle |
| (view only) | 2 | Discharge coefficient (Be) |
| P603 | G | Maximum Head (preset to P007) |
| P801 | G | Range Extension |
| P608 | G | Flowrate Units |

# BS-3680 / ISO 4359 Rectangular Flume




| Parameter | Index | Value |
|---|---|---|
| P600 | G | 6–ISO 4359 Rectangular Flume |
| P602 | 1 | Approach width (B) |
| | 2 | Throat width (b) |
| | 3 | Hump Height (p) |
| | 4 | Throat length (L) |
| (view only) | 5 | Velocity coefficient (Cv) |
| (view only) | 6 | Discharge coefficient (Cd) |
| (view only) | 7 | Cross sectional area |
| P605 | G | Zero Head |
| P608 | G | Flowrate Units |

# Palmer Bowlus Flume

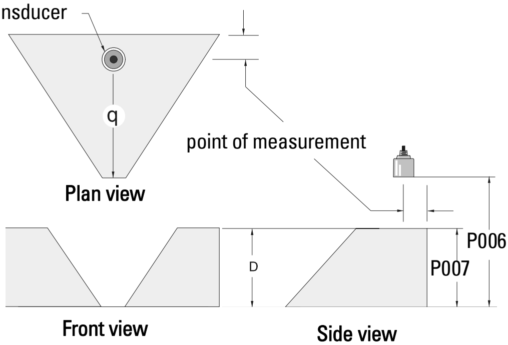



| Parameter | Index | Value |
|---|---|---|
| P600 | G | 2–Palmer Bowlus Flume |
| P602 | 1 | Flume width (D) |
| P603 | G | Maximum Head (preset = P007) |
| P604 | G | Maximum Flow |
| P605 | G | Zero Head |
| P606 | G | Time Units |

## Application Information

- Sized by pipe diameter, D
- Flume relief is trapezoidal
- Designed to install directly into pipelines and manholes
- Head is referenced to bottom of the throat, not bottom of the pipe
- For rated flows under free flow conditions, the head is measured at a distance of D/2 upstream from the beginning of the converging section

# H Flume




| Parameter | Index | Value |
|---|---|---|
| P600 | G | 3–H Flume |
| P602 | 1 | Flume height (D) |
| P603 | G | Maximum Head (preset = P007) |
| P604 | G | Maximum Flow |
| P606 | G | Time Units |

- Sized by maximum depth of flume, D
- Approach is preferably rectangular, matching width and depth for distance 3 to 5 times the depth of the flume
- May be installed in channels under partial submergence (ratio of downstream level to head). Typical errors are:
  - 1% @ 30% submergence
  - 3% @ 50% submergence
- For rated flows under free flow conditions, the head is measured at a point downstream from the flume entrance

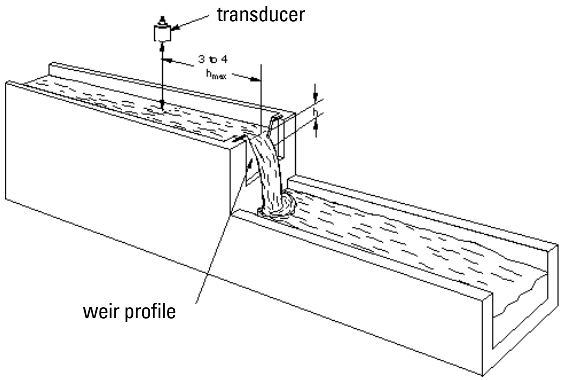
| Flume Size (D in feet) | Point of Measurement cm | inches |
|---|---|---|
| 0.5 | 5 | 1¾ |
| 0.75 | 7 | 2¾ |
| 1.0 | 9 | 3¾ |
| 1.5 | 14 | 5½ |
| 2.0 | 18 | 7¼ |
| 2.5 | 23 | 9 |
| 3.0 | 28 | 10¾ |
| 4.5 | 41 | 16¼ |

- H flumes come with a flat or sloping floor. The same flow table can be used as error is less than 1%.

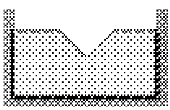
# PMDs that use Exponential Equation

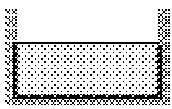
For Primary Measuring Devices (PMDs) that measure flow by an exponential equation use these parameters. Ensure that you use the correct exponent for your PMD; the values below are samples only.

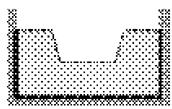
### Standard Weirs

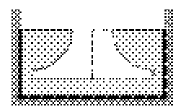



## Applicable Weir Profiles


V-notch or triangular


suppressed rectangular

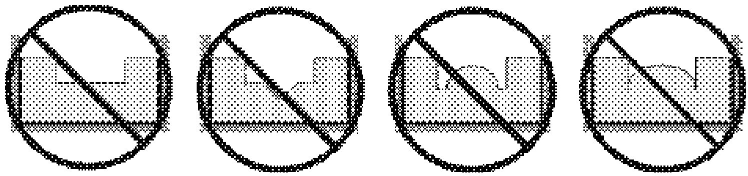

cipolletti or trapezoidal


sutro or proportional

| Parameter | Index | Value | |
|---|---|---|---|
| P600 | G | 1–Exponential Function | |
| P601 | G | Weir Type | Value[1] |
| | | V-notch | 2.50 |
| | | Suppressed rectangular | 1.50 |
| | | Cipolletti or trapezoidal | 1.50 |
| | | Sutro or proportional | 1.00 |
| P603 | G | Maximum Head | |
| P604 | G | Maximum Flow | |
| P606 | G | Time Units | |
| P801 | G | Range Extension | |

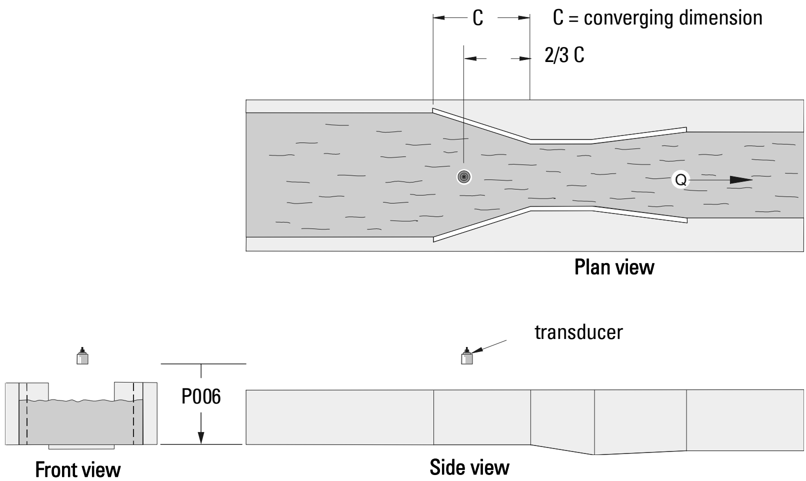
1. Values are samples only. Consult your weir manufacturer’s documentation for the correct flow exponent.

# Non-Applicable Weir Profiles




Flows through these weirs can be measured using the universal flow calculation P600 = 4 or 5. See *Universal Calculation Support* on page 111.

# Parshall Flume

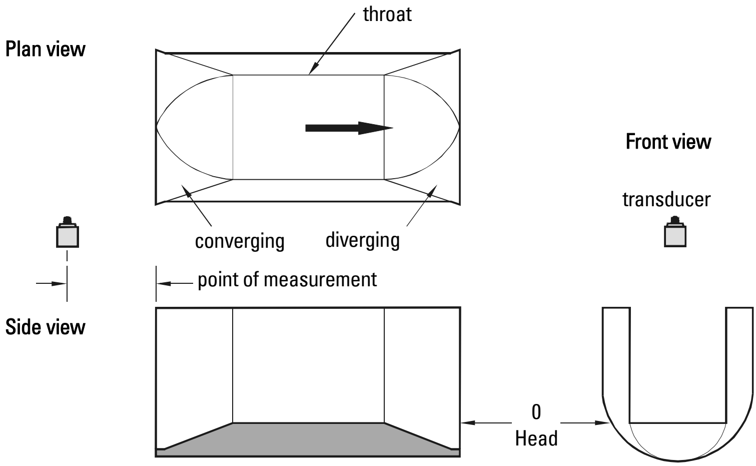



### Application Information

- sized by throat width
- set on solid foundation
- For rated flows under free flow conditions the head is measured at $^2/_3$ the length of the converging section from the beginning of the throat section.

| Parameter | Index | Value |
|---|---|---|
| P600 | G | 1–Parshall Flume |
| P601 | G | 1.22–1.607 (consult your flume documentation) |
| P603 | G | Maximum Head |
| P604 | G | Maximum Flow (Q) |
| P606 | G | Time Units |

# Leopold Lagco Flume



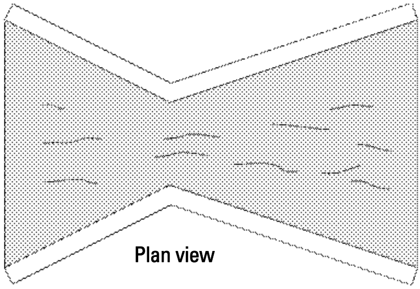

| Parameter | Index | Value |
|---|---|---|
| P600 | G | 1–Leopold Lagco Flume |
| P601 | G | 1.55 |
| P603 | G | Maximum Head (preset P007) |
| P604 | G | Maximum Flow |
| P605 | G | Zero Head |
| P606 | G | Time Units |

## Application Information

- Designed to be installed directly into pipelines and manholes
- Leopold Lagco may be classed as a rectangular Palmer-Bowlus flume
- Sized by pipe (sewer) diameter
- For rated flows under free flow conditions the head is measured at a point upstream referenced to the beginning of the converging section. Refer to the following table:

| Flume Size (pipe diameter in inches) | Point of Measurement | |
|---|---|---|
| | cm | inches |
| 4-12 | 2.5 | 1 |
| 15 | 3.2 | 1¼ |
| 18 | 4.4 | 1¾ |
| 21 | 5.1 | 2 |
| 24 | 6.4 | 2½ |
| 30 | 7.6 | 3 |
| 42 | 8.9 | 3½ |
| 48 | 10.2 | 4 |
| 54 | 11.4 | 4½ |
| 60 | 12.7 | 5 |
| 66 | 14.0 | 5½ |
| 72 | 15.2 | 6 |

# Cut Throat Flume




### Application Information

- Similar to Parshall flume except that the floor is flat bottomed and throat has no virtual length.
- Refer to manufacturer's specifications for flow equation and point of head measurement.

| Parameter | Index | Value |
|---|---|---|
| P600 | G | 1–Cut Throat Flume |
| P601 | G | 1.55 |
| P603 | G | Maximum Head (preset P007) |
| P604 | G | Maximum Flow |
| P606 | G | Time Units |



# Universal Calculation Support

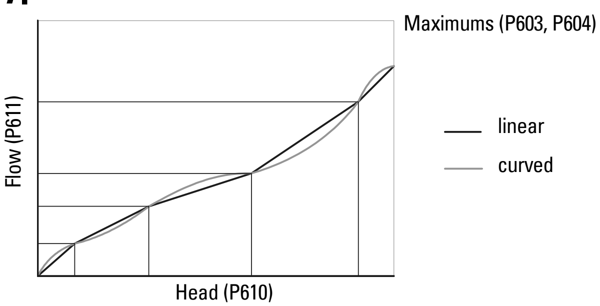
When the primary measuring device (PMD) doesn't fit one of the standard types it can be programmed using a universal characterization. When Universal is selected as the PMD type (P600) then both P610 and P611 must be entered to define the flow.

Two curve types are supported:

- P600 = 4–linear (piecewise linear)
- P600 = 5–curved (cubic spline)

Both are shown in the following chart.

## Typical Flow Characterization



Characterization is achieved by entering the head (P610) and corresponding flow (P611), either from empirical measurement or from the manufacturer's specification. The more breakpoints that are defined, the more accurate will be the flow measurement.

Breakpoints should be concentrated in areas exhibiting the higher degrees of non-linear flow. A maximum of 32 breakpoints can be defined. The curve's endpoints are automatically set to (0,0) and (Maximum Head P603, Maximum Flow P604). With up to 32 user defined breakpoints, the curve has a maximum of 34 points.

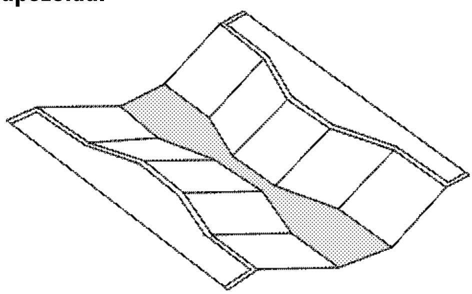
Use as many breakpoints as required by the complexity of your PMD.

See Flow Calculation on page 298 for more information.

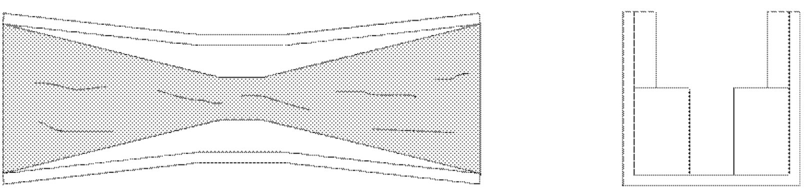
# Example Flumes

These example flumes would both require a universal calculation.

**Trapezoidal**

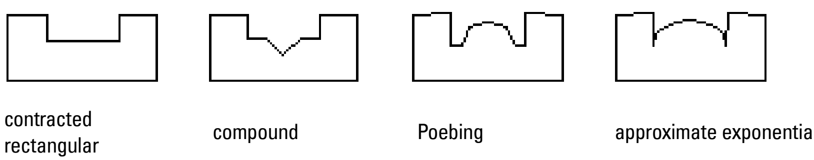


**Dual Range (nested) Parshall**



# Example Weirs

These weirs could require universal calculation.

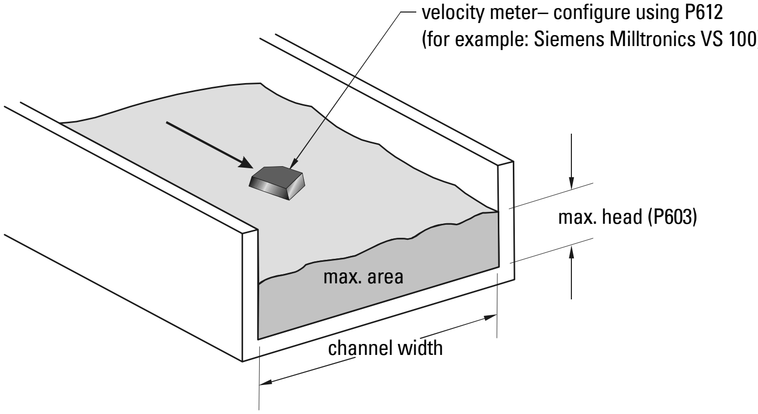



For further information regarding universal flow calculations, see *Flow Calculation* on page 298.

# Area x Velocity

## Example

### Rectangular Channel with Velocity Sensor




Area x Velocity calculations allow you to define an OCM installation when the cross-sectional area of the channel and the velocity are known. This information is used by the customer to calculate and enter Maximum Flow (P604).

### To calculate maximum flow:

1. Calculate maximum area.

   max. area = channel width x max. head (P603)

   ie: max area = 2 m x 0.1 m = 0.2 $m^2$

2. Determine maximum velocity from velocity meter. This will be the actual numerical value related to the 20mA output on the velocity meter.

   ie: max. velocity = 4.5 m/s

3. Calculate maximum flow.

Maximum Flow (P604) = maximum area x maximum velocity

Convert this value to appropriate units and enter it into Maximum Flow (P604).

   ie: max. flow = 0.2 $m^2$ x 4.5 m/s = 0.9 $m^3$/s

**Note:** All calculations must be based on the same units (channel width and max. head).

Round pipe with velocity sensor, as well as Universal Linear and Cubic Area PMDs also require the customer to manually determine maximum flow using area and velocity.

For more information on universal area calculations, see *Area Calculation* on page 299.

# Handling Flow Events

The overflow / underflow parameters allow the SITRANS LUC500 to react to flow conditions caused by storms or other unusual events. When a flow event is entered:

- **Logging starts.** (See *Data Logging* on page 79).
- **Relays are overridden.** (Described below).
- **Cost Reduction settings are overridden (**See *Saving Energy* on page 93).
- **Control relays are tripped.** (Relays set with P111 = 61 are tripped).
- **Communications are updated.** (See *Communications* section).
- **P169 is updated.** (Described below).

Below, the overflow detection comes from an external device connected through discrete input 5. All pump relays are turned off and OCM is logged on transducer 2.

| Parameter | Primary Index | Secondary Index | Value | Description |
|---|---|---|---|---|
| P160 | 1 | | 2:5 | Discrete input five supplies the overflow signal as flow condition 1 |
| P163 | 1 | | 10 | Calm the input by 10 seconds |
| P164 | 1 | | 360 | The overflow can last up to 6 hours |
| P165 | 1 | | 2 | The pump control relays are forced off during the event to keep the storm water from upsetting the treatment facility |
| P165 | 2 | 1 | 2 | |
| P165 | 3 | 1 | 2 | |
| P165 | 4 | 1 | 2 | |
| P166 | 1 | | 2 | The overflow is totalized by transducer 2 |

# Setting Input Source

The source for detecting a flow event can be a discrete input, the material level reading, or the material rate of change. Use P160–Overflow / Underflow Level Source to define which input triggers flow events. The parameter is a split value with x as the trigger type and y as the input number.

| x | Input | y | Index |
|---|---|---|---|
| 1 | transducer level – overflow | 1 | transducer 1 |
| | | 2 | transducer 2 |
| | | 3 | average, difference or sum |
| 2 | discrete input – overflow | 1 to 8 | base |
| | | 1 to 16 | with 8DI card |
| 3 | transducer level – underflow | 1 | transducer 1 |
| | | 2 | transducer 2 |
| | | 3 | average, difference or sum |
| 4 | discrete input – underflow | 1 to 8 | base |
| | | 1 to 16 | with 8DI card |
| 5 | transducer rate– overflow | 1 | transducer 1 |
| | | 2 | transducer 2 |
| | | 3 | average, difference or sum |
| 6 | transducer rate– underflow | 1 | transducer 1 |
| | | 2 | transducer 2 |
| | | 3 | average, difference or sum |

Flow events are indexed by flow condition, allowing up to 4 flow conditions to be monitored. When more than one flow condition is being logged, read P317 to determine which flow condition the log pertains to.

# Level Input Example

The advantage of setting overflow (or underflow) setpoints is that other actions can be triggered off of the overflow and underflow events. This is useful for combined sewer overflow (CSO) reporting.

**Note:** For OCM to work on an overflow event, the dual point feature must be installed. This feature is sold separately.

To detect an overflow event, shut down all pumps, and start logging OCM, do the following:

| Parameter | Primary Index | Secondary Index | Value | Description |
|---|---|---|---|---|
| P160 | 1 | | 1:1 | Sets flow condition 1 as an overflow event to be triggered by a level reading of 95% and an overflow reset at 90%. |
| P161 | 1 | | 95% | |
| P162 | 1 | | 90% | |
| P165 | 1 | 1 | 1 | Sets relays 1, 2, and 3 to be forced OFF when flow condition 1 is detected. |
| P165 | 2 | 1 | 1 | |
| P165 | 3 | 1 | 1 | |
| P166 | 1 | | 2 | Sets transducer two as the OCM total |

# Discrete Input Example

Discrete inputs can be used to indicate overflow and underflow events and these events can be used to drive control relays and report status through communications.

**Note:** You can use discrete inputs for other functions by using the Report subsystem or checking the DI state through communications. See *Report by Exception* on page 72 or *Communications* section.

### Overflow

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 61 | This setup sets discrete input number 6 to indicate an overflow event as flow condition 2. That event triggers control relay number 5. |
| P160 | 2 | 2:6 | |
| P163 | 2 | 5.0 | |
| P164 | 2 | 360 | |

### Underflow

| Parameter | Index | Value | Description |
|---|---|---|---|
| P111 | 5 | 61 | This sets up discrete input number 6 to indicate an underflow event as flow condition 3. That event triggers control relay number 5. |
| P160 | 3 | 4:6 | |
| P163 | 3 | 5.0 | |
| P164 | 3 | 360 | |

## Rate of Change Example

To configure the rate of change on transducer number two to detect an underflow as flow condition 4:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P160 | 4 | 6:2 | Use rate 2 as underflow detection |
| P161 | 4 | 95% | Start at 95% of filling rate |
| P162 | 4 | 90% | End at 90% of filling rate |

These rate values are specified as a percentage of P702–Filling Indicator.

# Setting Event Results

Once the input is set up to detect the flow event you can change how the relays react during a flow event. Set P165–Overflow / Underflow Relay Action to the required relay state.

# Monitoring Flow Events

Flow events can be monitored using the optional data logging feature or by using a report by exception.

To set up data logging see *Data Logging* on page 79.

To set up a report see *Report by Exception* on page 72.

To check the immediate status of the instrument, view P169 while in run mode. A value of **1** indicates that there is a flow event going on. A **0** indicates that there is no flow event. When more than one flow condition is being logged, read P317 to determine which flow condition the log pertains to.

# Testing the Configuration

After programmed the unit, you must test the device to ensure that it performs to your specifications. This test can be run in simulation mode or by varying the level in your application. The latter is preferred as it more accurately represents running conditions. However, if it is not possible to do a physical test, a simulation will ensure that control programming is correct.

# Simulation

In simulation mode, the LCD display reacts to the simulated level changes. Alarm relays will also react to the simulation, but any pump or control relays will not react.

To allow pump or control relays to operate on the simulated level, set P000 to -1.

## Simulating a Single Measurement

Access the appropriate parameter (Press PROGRAM and then enter the parameter number). Press TRANSDUCER 5 times to overcome Echo Lock (P711), if applicable: the associated Reading is displayed in the Parameter Value field, and any alarm relays are set accordingly.

**To verify Reading calculations (P920 to P926)...**

1. Key in a material level in Units (P005) or% of Span (P007).
2. Press ENTER : the calculated Reading is displayed.
3. Verify the calculated Reading.
4. To start a simulation from the level entered, press ARROW ▲ or ▼.

## Simulating a Level Cycle

**To start a (P920, P921, P922, or P923) simulation (from level = 0)...**

Press ENTER to simulate level rise and fall at 1% of Span / second. Press ARROW ▲ and ▼ to adjust the simulated rate of rise or fall. The maximum rate is 4 % of span

| Action | State (prior to pressing key) | Effect |
|---|---|---|
| Press ▲ | Stop | Rise at 1 % of Span / second |
| | Rise at 1 % of Span / second | Rise at 4 % of Span / second (max.) |
| | Rise at 4 % of Span / second (max.) | No effect |
| | Fall at 1 % of Span / second | Stop |
| | Fall at 4 % of Span / second | Fall at 1 % of Span / second |
| Press ▼ | Stop | Fall at 1 % of Span / second |
| | Rise at 1 % of Span / second | Stop |
| | Rise at 4 % of Span / second (max.) | Rise at 1 % of Span / second |
| | Fall at 1 % of Span / second | Fall at 4 % of Span / second (max.) |
| | Fall at 4 % of Span / second | No effect |

When the level rises to 100% or falls to 0% it reverses direction at the same rate.

# Checking Volume Characterization

**To confirm universal volume calculations (P050 = 9, 10):**

1. Go to P920
2. Key in a level associated with a known volume
3. Press ENTER ↵
4. Check the returned volume against the manufacturer's chart
5. Change parameters P054 and P055, as required
6. Repeat steps 2 to 5 until the volume curve is verified

# Checking OCM Flow Characterization

**To confirm universal flow calculations (P600 = 4, 5):**

1. Go to P925
2. Key in a level associated with a known flow
3. Press ENTER ↵
4. Check the returned volume against the manufacturer's chart
5. Change parameters P610 and P611, as required
6. Repeat steps 2 to 5 until the flow curve is verified

# I/O Checkout

After installing the unit, we recommend that you perform a test to verify the wiring.

### Relays

Use P119 to force a state change and verify that the results are as expected (pump starts, alarm sounds, etc.).

### Discrete Inputs

Use P270 to force the input value and verify that the results are as expected.

1. Go to P270[DI] where DI = the discrete input to be tested
2. Set to 0 to force the input off
3. Go to P275[DI] to verify that the value is forced
4. Check the state of outputs to ensure that they respond as expected
5. Go to P270[DI]
6. Set to 1 to force the input on
7. Go to P275[DI] to verify that the value is forced
8. Check the state of outputs to ensure that they respond as expected

For further information, see *Discrete Inputs* on page 53.

### mA Input

Use P254 to test the mA input value against a true level. Use a trusted external mA source to generate the signal required for testing and verify the incoming signal with P260. Check that the system responds as expected as the mA level is changed.

### mA Output

Use an external device to test the mA output against the measured level. Check that the mA value changes to reflect the changes in the measured level.

### Reset for Run Mode

Once testing is complete and the unit is ready for operation it is good practice to clear any pump interlocks by setting P510[0] to 0.

# Application Test

If you are testing the application by varying the material level (the preferred test method) make sure that none of the control devices are connected (or at least no power is available to them).

If you are testing the application in simulation mode (and P000 is not -1), control relays are not energized and control devices can remain connected.

While the level is being cycled, check the results of the discrete inputs by either closing the circuit externally (preferred) or using P270 Discrete Input Function to force the input ON or OFF. Try all possible combinations to thoroughly test the setup. For each combination, run a complete cycle to verify that the pumps operate as expected.

Monitor system performance carefully, under all anticipated operating conditions.

1. When the SITRANS LUC500 performs exactly as required, programming is complete.
2. If alternate Reading units, Failsafe action, or relay operation is desired, update the parameters for the new functionality.
3. If the system performance experiences problems, see *Appendix C–Troubleshooting* on page 301.

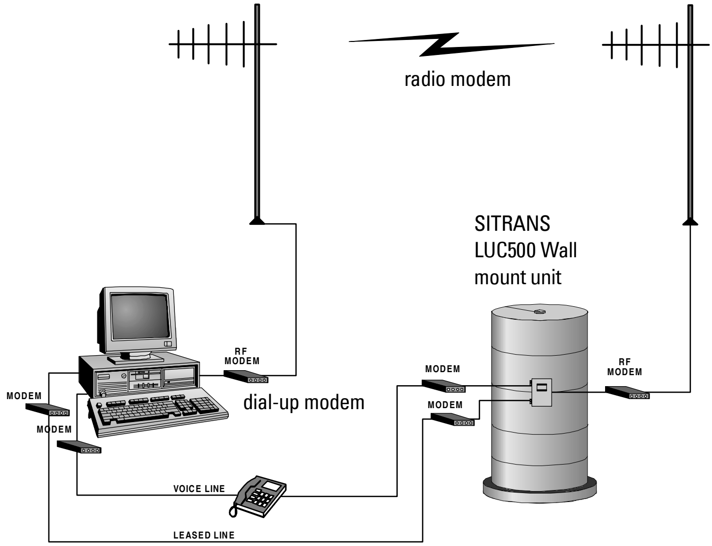
If you cannot observe all operating conditions during the System Performance Evaluation, use the level simulation (see page 117) to verify programming.

When a simulation is run, alarm relays will react to the simulated level change, but control relays will not react. You can set P000 to value **-1** to trigger the control relays based on the simulated level.

Retest the system every time you adjust any control parameters.

# Communications

The SITRANS LUC500 is an integrated level and pump controller capable of communicating process information to a Supervisory Control and Data Acquisition (SCADA) system, via a serial device such as a radio modem, leased line, or dial-up modem.




The SITRANS LUC500 supports the following communication protocols:

- Modbus RTU/ASCII–base unit on RS-232 or RS-485 transport
- PROFIBUS DP–optional SmartLinx® module
- Remote I/O–optional SmartLinx module
- DeviceNet1–optional SmartLinx module

# Communication Ports

The SITRANS LUC500 comes with two communication ports on the base unit and one more port available on all of the option cards:

| Port | Connection | Location | Interface |
|---|---|---|---|
| 1 | RJ-11 connector | Rack: front of unit<br>Panel: front of unit<br>Wall mount: inside enclosure | RS-232 |
| 2 | terminal block | Rack: terminal board<br>Panel: terminal board<br>Wall mount: terminal block | RS-232 |
| 3 | option card | Rack: terminal board<br>Panel: terminal board<br>Wall mount: option card | RS-485 |

1. DeviceNet is a registered trademark of Open DeviceNet Vendor Association

By using RS-485 instead of the more common RS-232, you can run communications cable much farther and you can have multiple slave units on the network, addressed by P771–Network Address.



# Modbus

Modbus is an industry standard protocol used by SCADA and HMI systems, and uses the SITRANS LUC500's RS-232 ports to communicate. For a description of the Modbus protocol, contact your local Schneider representative.

The Modbus protocol is supported in the base unit and is configurable using the Communications parameters, P770 to P782.

To set up communications with a Modbus RTU master device on port 2 using a modem, set the following parameters:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 2 | 3 | Modbus RTU slave |
| P771 | 2 | 1 | Network address, only used for RS-485 |
| P772 | 2 | 9.6 | Data rate of 9600 baud |
| P773 | 2 | 0 | No parity, common setting |
| P774 | 2 | 8 | 8 data bits, common setting |
| P775 | 2 | 1 | 1 stop bit, common setting |
| P776 | 2 | 0 | No hardware flow control |
| P777 | 2 | 0 | No key up delay |
| P778 | 2 | 1 | Communicate through a modem |
| P779 | 2 | 30 | Keep connection open for 30 seconds of silence, then hang up |
| P782 | 2 | 0 | Index parameter values globally |

The master device is expected to dial into the modem attached to the SITRANS LUC500 and request information through Modbus commands. If there is a silent period for longer than 30 seconds, the SITRANS LUC500 will hang up the modem and wait for another call.

To assist when connecting modems to the SITRANS LUC500, Siemens Milltronics offers an External Modem Kit to make connection easy. The RS-232 External Modem Kit can be used with the SITRANS LUC500 and at the master level. An RS-485 External Modem Kit is also available for multi-drop applications. Please see our web site at **www.siemens.com/processautomation** for more information.

# Optional SmartLinx® Cards

The standard SITRANS LUC500 unit may also be enhanced with Siemens Milltronics' SmartLinx® communication modules that provide an interface to popular industrial communication systems.

This manual only describes the built-in communications. For more information on SmartLinx, please consult the appropriate SmartLinx instruction manual.

# Dolphin Plus

Dolphin Plus makes it easy to record and compare parameter sets for all SITRANS LUC500 units in your company. Dolphin Plus uses a proprietary protocol called *Dolphin* to communicate with Siemens Milltronics instruments. This protocol is set when P770 = 1. For more information on Dolphin Plus, or to obtain a copy of the software, contact your Siemens Milltronics representative.

By default the settings for port 1 (RJ-11 connection) and Dolphin Plus match. These settings are:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P700 | 1 | 1 | Dolphin |
| P772 | 1 | 115.2 | Data rate of 115.2 Kilo baud |
| P773 | 1 | 0 | No parity, common setting |
| P774 | 1 | 8 | 8 data bits, common setting |
| P775 | 1 | 1 | 1 stop bit, common setting |
| P776 | 1 | 0 | No hardware flow control |

# Communications Installation

## Wiring Guidelines

- RS-232 maximum cable length is 15 meters (50 feet)
- RJ-11 maximum cable length is 3 meters
- RS-485 maximum length is 1,220 meters (4,000 feet)
- recommended cable for RS-485 is Belden19842 or equivalent
- use 24 AWG (minimum)
- use good quality communication grade (shielded twisted pairs) cable that is recommended for RS-232 for ports 1 and 2
- run the communication cable separately from power and control cables (do not wrap your RS-232 or RS-485 cable to the power cable or have them in the same conduit.)
- use shielded cable and connect to ground at one end only
- follow proper grounding guidelines for all devices on the bus

**Note:** Improper wiring and incorrect choice of cables are two of the most common causes of communication problems.

Communications Installation

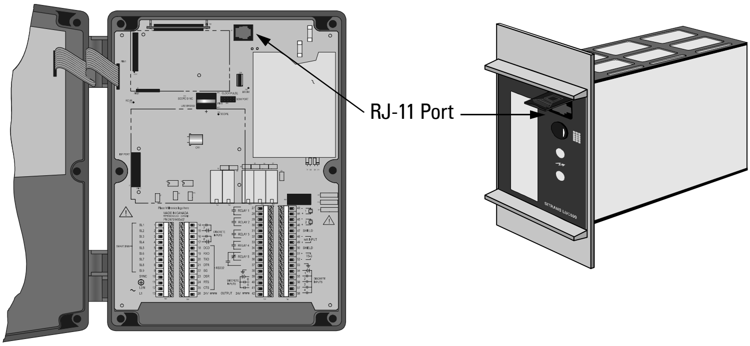
## Ports 1, 2, and 3

| Port | Rack or Panel Mount | Wall Mount |
|---|---|---|
| 1 | RS-232 port (RJ-11 modular telephone jack) is on the unit's front and is generally used with a laptop computer. | RS-232 port (RJ-11 modular telephone jack) is on the motherboard and is generally used with a laptop computer. |
| 2 | RS-232 port is on the terminal block. This port is generally used with a modem but can also be used with a direct connector to HMI. | |
| 3 | Connections for the RS-485 port are on the terminal block and are used to multidrop multiple devices. | Connections for the RS-485 port are on the optional I/O cards and are used to multidrop multiple devices. |

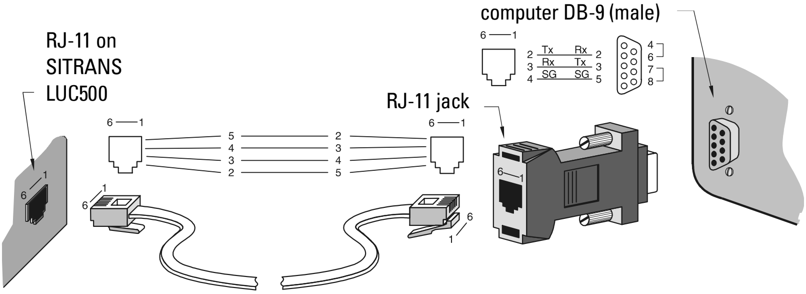
1. Belden is a registered trademark of Belden Wire & Cable Company

# Port 1: RS-232 RJ-11 Jack

The RJ-11 port is inside the enclosure of the Wall mount, and on the face of the rack and panel units (see below).




To connect the unit using RS-232 to a PC, use the cable as shown:

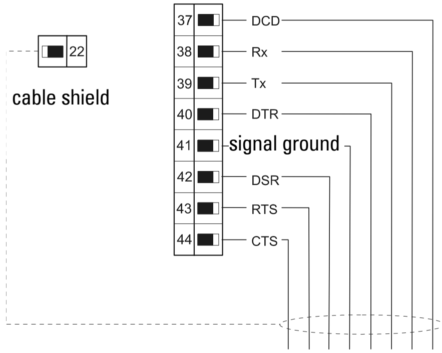



**Note:** Jumper pins 4-6 and 7-8 at the DB-9.

# Port 2: RS-232 Terminal Block

## Rack or Panel Mount

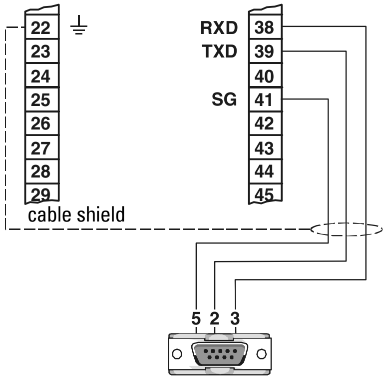
The terminal blocks of the Rack and Panel units use pins 37 to 44 for RS-232 port 2.



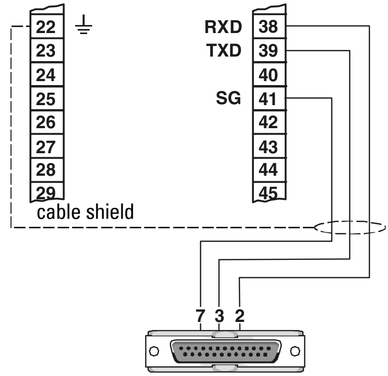

You can use terminal block 46 for the cable shield; however, block 47 and 48 are the power supply so use caution.

## Rack or Panel to PC Connection

To connect the terminal block to a computer that does not use a flow control, use the following connection:



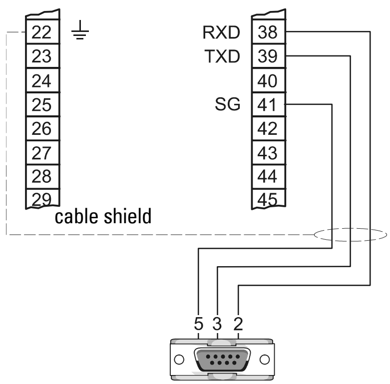

9-Pin D-shell RS-232 to PC (Female)



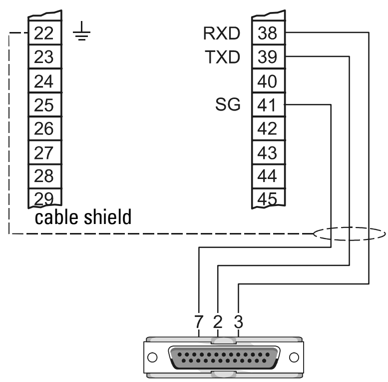

25-Pin D-shell RS-232 to PC (Female)

## Rack or Panel to Modem Connection

To connect the terminal block to a modem that does not use a flow control, use the following connection:




9-Pin D-shell RS-232 to Modem (Male)



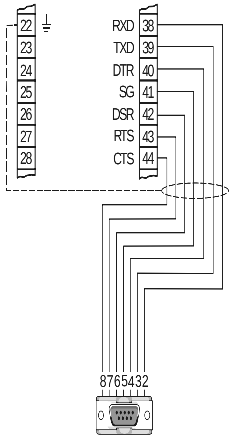

25-Pin D-shell RS-232 to Modem (Male)

**Note:** Modems switch Tx and Rx, therefore, connect Tx directly to Tx and Rx directly to Rx when wiring a modem.

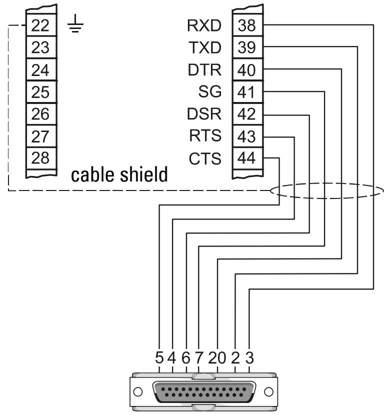
Communications Installation

### With Hardware Flow Control (Rack or Panel Mount)

To connect the terminal block to an external modem using hardware flow control, use the following connection:

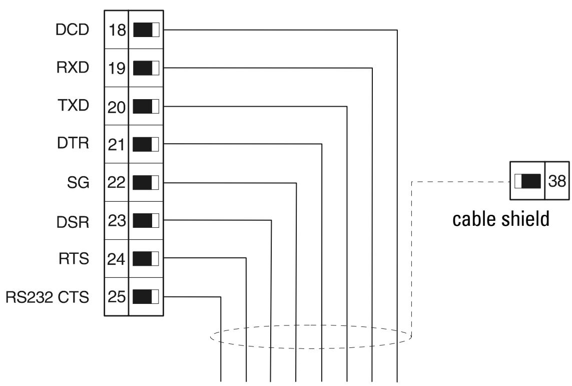



9-Pin D-shell RS-232 to Modem (Male) with hardware flow control



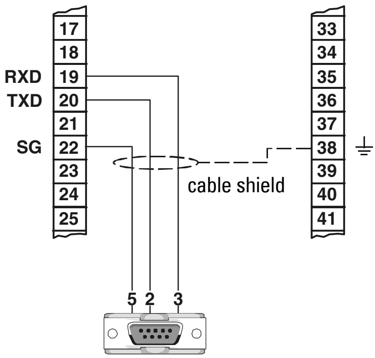

25-Pin D-shell RS-232 to Modem (Male) with hardware flow control

## Wall Mount

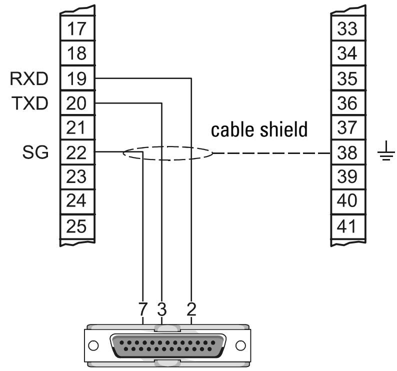


## Wall Mount to PC Connection

To connect the terminal block to a computer that does not use a flow control:



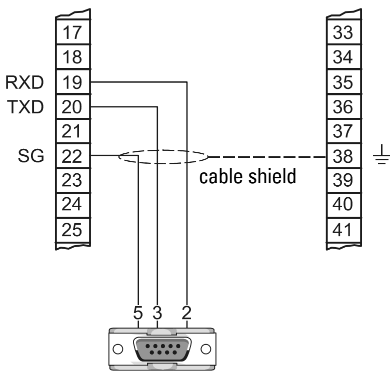
9-Pin D-shell RS-232 to PC (Female)



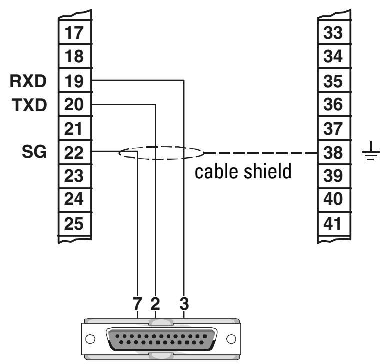
25-Pin D-shell RS-232 to PC (Female)

## Wall Mount to Modem Connection

To connect the terminal block to a modem that does not use a flow control:



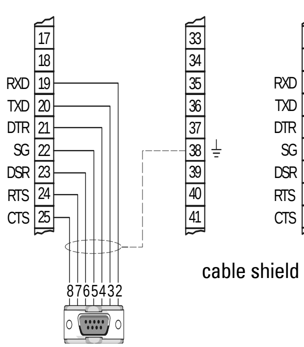
9-Pin D-shell RS-232 to Modem (Male)

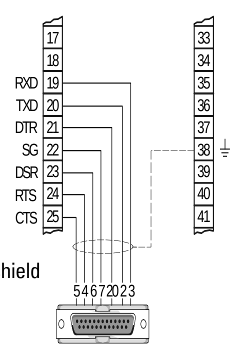


25-Pin D-shell RS-232 to Modem (Male)

## With Hardware Flow Control (Wall Mount)

To connect the terminal block to a modem that uses flow control:




cable shield

9-Pin D-shell RS-232 to Modem (Male)

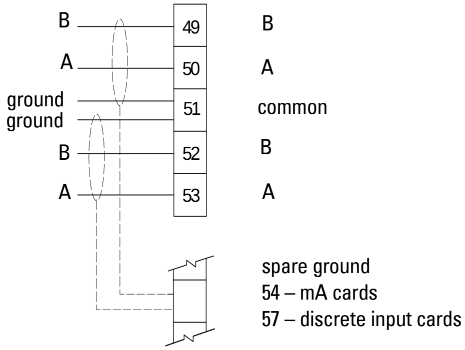
25-Pin D-shell RS-232 to Modem (Male)

# Port 3: RS-485

To connect multiple RS-485 devices together, connect **A** to **A**, **B** to **B**, **signal ground** to **signal ground (common)**. **A** can also be marked as - and **B** as +. For more information, see the Application Guide "Connecting SITRANS LUC500 to an RS-485 Network" on our web site at **www.siemens.com/processautomation**.

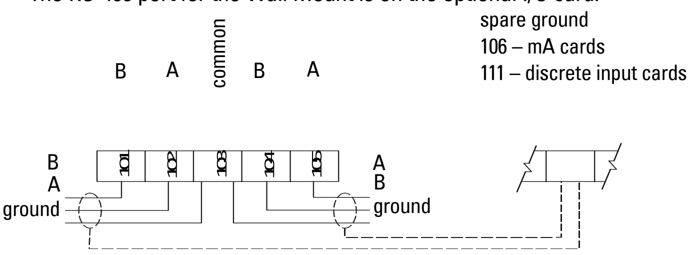
## Rack and Panel Mount

The RS-485 port for the Rack and Panel is on the terminal blocks but is enabled only if there is an optional I/O card installed.




## Wall Mount

The RS-485 port for the Wall Mount is on the optional I/O card.




# Configuring Communication Ports (Parameters)

The 11 parameters listed are indexed to the three communication ports, unless otherwise noted. An asterisk (*) identifies the preset value.

| Port | Description |
|---|---|
| 1 | RS-232 port (RJ-11 modular telephone) |
| 2 | RS-232 port on terminal block |
| 3 | The RS-485 port for the rack and panel is on the terminal blocks. The RS-485 port for the wall mount is on the optional I/O card. |

**Notes:**
- The RS-485 port is available on an optional I/O card.
- For parameters 770 to 780, port 3 and index 3 is only available if there is an optional I/O card present.

# P766 Communications Port Security

*The parameter will selectively enable security for a specific communications port.*

| | | | |
|---|---|---|---|
| Primary Index | port | | |
| Values | 0 | * | Preset, security disabled for specified port |
| | 1 | | security enabled for specified port |
| Related | • P767 Communications Lock<br>• P768 PIN Entry Failures<br>• P769 Communications Lock State | | |

# P767 Communications Lock

*A four digit pin which can be modified by keypad or remotely via Modbus or modem if successfully logged in.*

| | |
|---|---|
| Primary Index | global |
| Values | 4 digit PIN |
| Related | • P766 Communications Port Security<br>• P768 PIN Entry Failures<br>• P769 Communications Lock State |

**Note:** P767 applies to communication using Modbus protocol only.

When the correct pin is sent to the SITRANS LUC500 remotely, a safe session is created. If the user makes three unsuccessful attempts to send the correct PIN, the session becomes unsafe, and the connection will be terminated.

Upon termination, the modem will disconnect when using a modem connection.

Three successive unsafe sessions will cause the SITRANS LUC500 to enter intruder lockout state, at which point it is impossible to unlock the unit remotely.

To clear the intruder lockout state, reset the PIN locally using the hand programmer. The same PIN may be entered again.

The following conditions will terminate the safe session, and the PIN will have to be re-entered:

- a modem disconnection
- A timeout as determined by P779 (this applies to both modem and direct connections). If a modem is used, it will go 'on-hook'. A direct connection will revert to a locked state.

# P768 PIN Entry Failures

*Reports number of unsuccessful PIN entries observed by SITRANS LUC500*

| | |
|---|---|
| Primary Index | port |
| Values | Range: 0 to 255 |
| | Can be reset to 0 to observe number of unsuccessful entries |
| Related | • P767 Communications Lock<br>• P769 Communications Lock State |

# P769 Communications Lock State

*Reports the lock state of the SITRANS LUC500 on specified port.*

| | | | |
|---|---|---|---|
| Primary Index | port | | |
| Values | 0 | * | Unlocked |
| | 1 | | Locked |
| | 2 | | Intruder Lockout |
| Related | • P766 Communications Port Security<br>• P767 Communications Lock<br>• P768 PIN Entry Failures | | |

# P770 Port Protocol

*The communications protocol used between the SITRANS LUC500 and other devices.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | * | Communications port disabled (preset for port 3) |
| | 1 | * | Siemens Milltronics Dolphin protocol (preset for port 1) |
| | 2 | | Modbus ASCII slave serial protocol |
| | 3 | * | Modbus RTU slave serial protocol (preset for port 2) |
| | 4 | | Modbus ASCII master |
| | 5 | | Modbus RTU master |
| | 6 | | Modbus RTU slave with unsolicited communications |
| | 7 | | Modbus ASCII slave with unsolicited communications |

The SITRANS LUC500 supports Siemens Milltronics' proprietary Dolphin format and the internationally recognized Modbus standard in both ASCII and RTU formats. Other protocols are available with optional SmartLinx cards.

- Use Dolphin protocol when connecting to a PC running the Dolphin Plus configuration tool.
- Use Modbus slave (P770 = 2 or 3) when communicating to a SCADA system.
- Use Modbus master (P770 = 4 or 5) when report by exception is used exclusively.
- Use Modbus slave with unsolicited communications (P770 = 6 or 7) when communicating to a SCADA system and issuing reports by exception. See *Communication Appendix D: Unsolicited Slave* on page 169.
- Use other SmartLinx-supported protocols when required by your existing network.

# P771 Network Address

*The unique identifier of the SITRANS LUC500 on the network.*

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 0 to 9999 |
| | Preset: 1 |

For devices connected with the Siemens Milltronics protocol, this parameter is ignored. For devices connected with a serial Modbus slave protocol, this parameter is a number from 1-247. The network administrator must ensure that all devices on the network have unique addresses. Do not use the value **0** for Modbus communications as this is the broadcast address and is inappropriate for a slave device.

# P772 Baud Rate

*The communication rate with the master device.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | 4.8 | | 4800 baud |
| | 9.6 | * | 9600 baud (preset and only option for port 3) |
| | 19.2 | * | 19,200 baud (preset for port 2) |
| | 115.2 | * | 115,200 baud (preset for port 1) |

This specifies the rate of communication in Kbaud. Any value may be entered, but the only values supported are those shown above. The baud rate should reflect the speed of the connected hardware and protocol used.

# P773 Parity

*The serial port parity.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | 0 | * | No Parity (only option for port 3) |
| | 1 | | Odd Parity |
| | 2 | | Even Parity |
| | 3 | | Mark Parity (=1) |
| | 4 | | Space Parity (=0) |

# P774 Data Bits

*The number of data bits per character.*

| Primary Index | communications port | |
|---|---|---|
| Values | Range: 5 to 8 | |
| | Preset: 8 (only option for port 3) | |
| | 8 | Modbus RTU |
| | 7 or 8 | Modbus ASCII |
| | 7 or 8 | Dolphin Plus |

# P775 Stop Bits

*The number of bits following the character message indicating the end of the message.*

| Primary Index | communications port |
|---|---|
| Values | Range: 1 or 2 |
| | Preset: 1 (only option for port 3) |

# P776 Port Flow Control

*The flow control used on the serial port.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | 0 | * | No flow control |
| | 1 | | RTS/CTS (Hardware flow control) |

The SITRANS LUC500 only supports hardware flow control (RTS/CTS) for port 2. Only select flow control if your connected device requires it.

# P777 Key up Delay

*The delay between asserting RTS and transmitting the first data bit.*

| Primary Index | communications port |
|---|---|
| Values | Range: 0-3000 milliseconds |
| | Preset: 0 |

This delay is built into the protocol for older radio modems that do not buffer data and require key up time. Consult your modem documentation.



# P778 Modem Available

*Sets the SITRANS LUC500 to use an external modem on the RS-232 port.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | 0 | * | No modem connected |
| | 1 | | Answer only |
| | 2 | | Dial only |
| | 3 | | Answer / Dial |

**Note:** For Report by Exception to send reports, either 2 or 3 must be selected.

# P779 Modem Inactivity Timeout

*Sets the time that the unit will keep the modem connected with no activity.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | Range: 0-9999 seconds | | |
| | 0 | * | No timeout |

To use this parameter, ensure that P778 (Modem Available)=1. If the line is idle and the P779 Modem Inactivity Timeout expires, then the modem is directed to hang up the line. Ensure that P779 is set longer than the standard polling time of the connected master device. Set P779 to **0** to disable the inactivity timer.

# P782 Parameter Index Location

*Determines where index information is stored for the parameter access area for the Modbus register map.*

| Primary Index | Global | | |
|---|---|---|---|
| Values | 0 | * | Global |
| | 1 | | Parameter-Specific |

### Global (0)

The primary and secondary index values are global (they affect all of the parameter access area at once) and stored in:

- primary index – R43,999
- secondary index – R43,998

### Parameter-Specific (1)

The primary and secondary index values are encoded into the format words found between R46,000 and R46,999. Each format word corresponds with the R44,000-series number in the parameter access map. For example, the format register R46,111 corresponds to the parameter P111 and the value is stored in R44,111. If Modbus protocol (P770 = 2 or 3) is not used this parameter is ignored.

# Configuring Unsolicited Slave (Parameters)

These parameters are used to configure an SITRANS LUC500 as a Modbus slave with the unsolicited communication option (P770 = 6 or 7). This setting is used when you need to connect to the SITRANS LUC500 as a slave most of the time but still need it to issue Report by Exception information to another slave device. These parameters vary the timing of the communication to ensure that collisions on the network are kept to a minimum.

See also *Communication Appendix D: Unsolicited Slave* on page 169.



## P486 Carrier Detection

*Determines how the SITRANS LUC500 will detect for communications carrier before sending a Report by Exception.*

| Primary Index | communications port | | |
|---|---|---|---|
| Values | 0 | | No carrier detection |
| | 1 | * | DCD – modem |
| | 2 | | Rx activity – network |

### No Carrier Detection

This option turns off the communication delay. The SITRANS LUC500 will attempt to issue a report by exception without first checking for existing communications (the timings from P487 and P488 still apply).

### DCD Method

Use the DCD method when the SITRANS LUC500 communicates through a modem. This method waits until the modem is hung up before attempting to communicate out.

### Rx Activity Method

Use the Rx Activity method when the SITRANS LUC500 is permanently connected to an RS-486 multi-drop network.

**Note:** The reporting system will not override a communication in progress (for example a SCADA system downloading information) to issue the report. It will always wait until the communication is complete.

# P487 Minimum Quiet Time

*Specifies the time, in ms, that the SITRANS LUC500 will wait before initiating an unsolicited Report by Exception.*

| | | |
|---|---|---|
| Primary Index | communications port | |
| Values | Range: 0-9999 milliseconds | |
| | Preset: 1000 | |

When the Report by Exception subsystem has a report to issue it will begin watching the communications carrier (as defined by P486) for a suitable quiet time. Once the time has elapsed, default is 1 second, then the Report by Exception subsystem will begin working.

All Modbus master parameters (P473 to P476) are used when the SITRANS LUC500 is acting as a master.

# P488 Holding Time Constant

Specifies the time, in ms, that the SITRANS LUC500 will wait after the Minimum Quiet Time before issuing Modbus master commands.

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 0-2000 milliseconds |
| | Preset: 100 |

When the Minimum Quiet Time has elapsed then the Holding Time begins. This constant is used so that if there are multiple EnviroRangers on the network they will not try to initiate communications simultaneously and cause collisions.

# Modbus Register Map

The SITRANS LUC500 uses the Modbus holding registers (R40,001 and up) to give SCADA systems access to relevant data. The table below shows how this data is mapped in the available registers. This map is only used when the protocol is set to Modbus Slave ASCII or Modbus Slave RTU.

## Register Map for Most Common Data

| Legend | |
|---|---|
| Type | The type of data held in the group of registers. |
| Start | The first register to hold the referenced data. |
| Data Type | The possible values of the data in the register. See Data Types on page 158 for more information. |
| Description | The type of data held in the individual registers. |
| #R | The number of registers used for the referenced data. |
| Read/Write | Indicates whether the register is readable, writeable or both. |

| Type | Description | Start | #R[1] | Data Type | R/W |
|---|---|---|---|---|---|
| Current Lock Status | | 40,061 | 1 | 0/1 | R/W |
| Order | Word Order for UINT32 and INT32 | 40,062 | 1 | 0/1 | R/W |
| Parameter Area Indexing | | 40,063 | 1 | 0/1 | R/W |
| ID | Milltronics Product Code | 40,064 | 1 | 1 | R |
| Single Parameter Access (SPA) | | R40,090 | 7 | see comm. appendix A on page 164 | |
| Date and Time | YYYY | 41,000 | 1 | 1970 to 2069 | R/W |
| | MM | 41,001 | 1 | 1 to 12 | R/W |
| | DD | 41,002 | 1 | 1 to 31 | R/W |
| | HH | 41,003 | 1 | 00 to 23 | R/W |
| | MM | 41,004 | 1 | 00 to 59 | R/W |
| | SS | 41,005 | 1 | 00 to 59 | R/W |
| | time zone | 41,006 | 1 | -2400 to 2400 | R/W |
| Point Data | Reading (3)[2] | 41,010 | 3 | -20,000 to 20,000 | R |
| | Volume (2)[3] | 41,020 | 2 | -20,000 to 20,000 | R |
| | Temperature (2) | 41,030 | 2 | -50 to 150 | R |
| | Totalizer for points 1 and 2 | 41,040 | 4 | INT32 | R/W |
| | Negative Totalizer for points 1 and 2 | 41,044 | 4 | INT32 | R/W |
| I/O | Discrete Inputs (8 or 16)[4] | 41,070 | 1 | Bit Mapped | R |
| | Relay Outputs (5) | 41,080 | 1 | Bit Mapped | R/W |
| | mA Input (1, 3, or 5)[5] | 41,090 | 5 | 0000 to 20,000 | R |
| | mA Output (2 or 4)[6] | 41,110 | 4 | 0000 to 20,000 | R/W |
| | Frequency Input (2) | 41,130 | 2 | 0000 to 20,000 | R |
| | Pulse Count Input (2) | 41,140 | 4 | UINT32 | R |
| | Trigger Status | 41,180 | 2 | Bit Mapped | R |
| Alarms | Global Alarms | 41,200 | 1 | Bit Mapped | R/W |
| | Point Status | 41,211 | 2 | Bit Mapped | R |
| Pump Control | Control and Status (5) | 41,400 | 5 | Bit Mapped | R/W |
| | Pump Faults (5) | 41,410 | 5 | Bit Mapped | R |
| | Pump on Setpoint (5) | 41,420 | 5 | 0000 to 10,000 | R/W |
| | Pump off Setpoint (5) | 41,430 | 5 | 0000 to 10,000 | R/W |

| | | | | | |
|---|---|---|---|---|---|
| Pump Control (con't) | Pumped Volume (2)[3] | 41,440 | 4 | UINT32 | R |
| | Pump Hours (5) | 41,450 | 10 | UINT32 | R |
| | Pump Starts (5) | 41,470 | 5 | 0000 to 10,000 | R |
| | Pump Capacity (5) | 41,480 | 5 | 0000 to 20,000 | R |
| | | | | | |
| Parameter Access | | 43,998 to 46999 | | | R/W |
| | | | | | |
| Report by Exception | Unit ID | 49,250 | 1 | 0000 to 9999 | R/W |
| | Exception Number | 49,251 | 1 | 1 to 32 | R |
| | Exception Type | 49,252 | 1 | 1 or 2 | R |
| | Exception Year | 49,253 | 1 | 1970 to 2069 | R |
| | Exception Month | 49,254 | 1 | 1 to 12 | R |
| | Exception Day | 49,255 | 1 | 1 to 31 | R |
| | Exception Hour | 49,256 | 1 | 00 to 23 | R |
| | Exception Minute | 49,257 | 1 | 00 to 59 | R |
| | Exception Second | 49,258 | 1 | 00 to 59 | R |
| | Value | 49,259 | 2 | UINT32 or float controlled by format | R |
| | | | | | |
| Data Logs | Last Logged Information | 49,500-49,559 | | | R |
| | Reset Logs | 49,668-49,676 | | | R/W |
| | Data Record Access | 49700-49,706 | | | R/W |
| | Log statistics Access | 49,710-49,717 | | | R/W |
| Alarms | Last Alarm | 49,720-49,724 | | | R/W |
| | Alarm reset | 49,730 | | | R/W |
| | | | | | |
| Open Data Log File | File Number | 49,800 | 1 | 220 | R/W |
| | Function Code | 49,801 | 1 | 1, 4 | R/W |
| | Max. Segment Length | 49,802 | 1 | 160 | R/W |
| | Response Code | 49,807 | 1 | 0, 2, 9 | R |
| | Data Log Number | 49,808 | 1 | 0 to 10 | R/W |
| | Ready for Next Block | 49,809 | 1 | 0 or 1 | W |
| | | | | | |
| Transfer Data Log File | File Number | 49,810 | 1 | 220 | R/W |
| | Function Code | 49,811 | 1 | 0, 1, 3, 4 | R/W |
| | Offset Byte Number | 49,814 | 2 | 0, 160, 320, … 4960 (UINT32) | R/W |
| | Response Code | 49,816 | 1 | 0, 2, 9 | R |
| | Block Size | 49,819 | 1 | 0 to 160 | R |
| | Data | 49,820 | 80 | UINT32 | R |

1. Maximum registers shown; fewer may be used depending on options installed.
2. Available as reading 1, reading 2, and Average, Difference, or Sum when in either Standard or Dual Point Mode. In Single Point Model, point 2 and 3 are only available if P001 = Average, Difference, or Sum. In Dual Point Mode, reading 1 and reading 2 are always available. Point 3 is only available if P001[3]= Average, Difference, or Sum.
3. 2$^{nd}$ volume available in Dual Point Mode only.
4. Indexed by 8 as standard, may vary with Optional cards installed.
5. 1 Index is standard, may vary with Optional cards installed.
6. 1 Index is standard, may vary with Optional cards installed

A more detailed explanation of each section follows.

# Current Lock Status (R40,061)

This register displays the current lock status for the port being used.

**Note:** When writing to this register, use Modbus commmand 06 (Preset Single Register) only. Modbus command 16 (Preset Multiple Registers) is not supported.

0 = unit unlocked – full access allowed

1 = unit locked

To unlock the unit, the PIN number stored in P767 must be written to register 40,061. When the SITRANS LUC500 is in Intruder Lockout mode, all Modbus register read/write attempts will time out.

# Word Order (R40,062)

This determines the format of unsigned, double-register integers (UINT32) and signed, double-register integers (INT32).

0 indicates that the most significant word (MSW) is given first

1 indicates that the least significant word (LSW) is given first

See the Unsigned Double Precision Integer (UINT32) data type on page 158 and Signed Double Precision Integer (INT32) on page 159 for more information.

# Parameter Area Indexing (R40,063)

This value identifies the type of indexing used in the Parameter Access area. See *P782 Parameter Index Location* on page 132 and *Parameter Access (R43,998 – R46,999)* on page 147 for details.

# Product ID (R40,064)

This value identifies the Siemens Milltronics device type. For SITRANS LUC500, the value is 1.

# Date and Time (R41,000 – R41,006)

The date and time can be read or written in registers 41,000 to 41,005 as defined in the Register Map.

Example: If you are located in Toronto, Canada and would like to set the date and time to February 14, 2001, 1:30 p.m. and 42 seconds, you would write the following:

| Register | Value | Description |
|---|---|---|
| R41,000 | 2001 | Year |
| R41,001 | 2 | Month |
| R41,002 | 14 | Day |
| R41,003 | 13 | Hour |
| R41,004 | 30 | Minutes |
| R41,005 | 42 | Seconds |

| | | |
|---|---|---|
| R41,006 | -5 | Time zone |

**Notes:**
- The time zone register (R41,006) is not required. It is used as a reference and does not affect the operation of the SITRANS LUC500.
- The Data Logs and the Alarm Logs do not use this date/time stamp format.

# Point Data (R41,010 – R41,031)

Measurement point data contains the current reading on the instrument. This is the same as shown on the device's LCD for reading, volume and temperature for each measurement point. The reading is based on the unit's operation, and could be level, distance, OCM flow, or volume. See *Parameter Reference* section for details.

The measurement registers are 41,010 to 41,012. The SITRANS LUC500 uses 41,010 when configured with a single transducer and 41,010 to 41,012 when configured with two transducers (P111=4 or 5 only). Two transducers can create three readings because they can generate an average, differential or sum reading (R41,012) as well as the two level readings (R41,010 and R41,11).

The available registers are:

| Data | Registers | Parameter |
|---|---|---|
| Reading | 41,010 to 41,012 | P920 |
| Volume | 41,020 | P924 |
| Temperature | 41,030 and 41,031 | P912 |

The reading is expressed as a percentage of full scale, multiplied by 100:

| Reading | Value |
|---|---|
| 0 | 0.00% |
| 5000 | 50.00% |
| 7564 | 75.64% |
| 20,000 | 200.00% |

**Note:** These values may contain numeric data for inoperative or malfunctioning points; refer to the alarm area (R41,200) for the operational status of the measurement points.

# Totalizer (R41,040 – R41,043)

The totalizers are stored as 32 bit integers using 2 registers. The totalizers can be read with R41,040 and R41,041 as totalizer for Point 1, and R41,042 and R41,043 as totalizer for Point 2. The totalizer values can be cleared by writing zero (0) to the registers.

# Negative Totalizer (R41,044 – R41047)

The negative totalizers are stored as 32 bit integers using 2 registers. The negative totalizers can be read with R41,044 and R41,045 as the negative totalizer for Point 1, and R41,046 and R41,047 as negative totalizer for point 2. The totalizer values can be cleared by writing zero (0) to the registers.

# Input/Output (R41,070 – R41,143)

The SITRANS LUC500 has discrete inputs, mA inputs, mA outputs and relay outputs. Details for each I/O type follow.

## Discrete Inputs (R41,070)

This table shows the current status of the discrete inputs. Only register 41,070 is used.

| Discrete Input | Data Address |
|---|---|
| 1 | 41,070, bit 1 |
| 2 | 41,070, bit 2 |
| 3 | 41,070, bit 3 |
| 4 | 41,070, bit 4 |
| 5 | 41,070, bit 5 |
| 6 | 41,070, bit 6 |
| 7 | 41,070, bit 7 |
| 8 | 41,070, bit 8 |
| 9 | 41,070, bit 9 |
| 10 | 41,070, bit 10 |
| 11 | 41,070, bit 11 |
| 12 | 41,070, bit 12 |
| 13 | 41,070, bit 13 |
| 14 | 41,070, bit 14 |
| 15 | 41,070, bit 15 |
| 16 | 41,070, bit 16 |

**Notes:**
- If discrete inputs 7 or 8 are defined as frequency or pulse, then the data address is undefined.
- Discrete inputs 9 through 16 are only available if the optional discrete input card is installed.

## Relay Outputs (R41,080)

This table shows the current status of the relays. A reading of **0** means that the relay function is not asserted and a **1** means that it is asserted. For example, a **1** for a pump relay means that the pump is running.

| Relay | Data Address |
|---|---|
| 1 | 41,080, bit 1 |
| 2 | 41,080, bit 2 |
| 3 | 41,080, bit 3 |
| 4 | 41,080, bit 4 |
| 5 | 41,080, bit 5 |

Values are written to control a relay only if P111 (Relay Control Function)=**65 (Communications)**. See *Parameter Reference* section for more details.

# mA Input (R41,090-41,094)

The mA input is scaled from 0 to 2,000 (0 to 20mA multiplied by 100). This displayed in P254, index by input. The registers used for the optional I/P card are shown below:

| Auxiliary I/P card | Register |
|---|---|
| None, 4AO, 8DI | 41,090 |
| 2 AI/2AO | 41,090-41,092 |
| 4 AI | 41,090-41,094 |

# mA Output (R41,110-41,113)

The mA output is scaled from 0 to 2,000 (0 to 20 mA multiplied by 100). This is displayed in P911. The registers used for the optional I/P card are shown below:

| Auxiliary O/P card | Register |
|---|---|
| None, 4AI, 8DI | None |
| 2 AI/2AO | 41,110-41,111 |
| 4 AO | 41,110-41,113 |

# Frequency Input (R41,130 – R41,131)

The frequency input is scaled from 0 to 20,000 (0 to 200% multiplied by 100).

Only discrete inputs 7 and 8 can act as frequency inputs, and they must be set using Discrete Input Function (P270 = 4 or 5):

| DI | Register |
|---|---|
| 7 | 41,130 |
| 8 | 41,131 |

If discrete inputs 7 or 8 are not defined as frequency inputs, the value in this register is undefined.

# Pulse Counter (R41,140 – R41,143)

The pulse counter holds the current total for the associated discrete input. Two registers are used to hold the integer value because the totals can become very large. See *Unsigned Double Precision Integer (UINT32)* on page 158 for more information.

The SITRANS LUC500 LCD cannot display the precise count, (it has four digits). However, the value available through communications is accurate.

Only discrete inputs 7 and 8 can act as pulse counters, and they must be set using Discrete Input Function (P270 = 4):

| DI | Registers |
|---|---|
| 7 | 41,140, 41,141 |
| 8 | 41,142, 41,143 |

# Trigger Status (R41,180-41,181)

The trigger status for each point can be read using R41,180 for triggers 1 to 16, and R41,181 for triggers 17 to 32. The values are displayed as UINT16, with each bit displaying the status of a trigger.

| Discrete Input | Data Address |
|---|---|
| 1 | 41,180, bit 1 |
| 2 | 41,180, bit 2 |
| 3 | 41,180, bit 3 |
| 4 | 41,180, bit 4 |
| 5 | 41,180, bit 5 |
| 6 | 41,180, bit 6 |
| 7 | 41,180, bit 7 |
| 8 | 41,180, bit 8 |
| 9 | 41,180, bit 9 |
| 10 | 41,180, bit 10 |
| 11 | 41,180, bit 11 |
| 12 | 41,180, bit 12 |
| 13 | 41,180, bit 13 |
| 14 | 41,180, bit 14 |
| 15 | 41,180, bit 15 |
| 16 | 41,180, bit 16 |

| Discrete Input | Date Address |
|---|---|
| 17 | 41,181, bit 1 |
| 18 | 41,181, bit 2 |
| 19 | 41,181, bit 3 |
| 20 | 41,181, bit 4 |
| 21 | 41,181, bit 5 |
| 22 | 41,181, bit 6 |
| 23 | 41,181, bit 7 |
| 24 | 41,181, bit 8 |
| 25 | 41,181, bit 9 |
| 26 | 41,181, bit 10 |
| 27 | 41,181, bit 11 |
| 28 | 41,181, bit 12 |
| 29 | 41,181, bit 13 |
| 30 | 41,181, bit 14 |
| 31 | 41,181, bit 15 |
| 32 | 41,181, bit 16 |

# Global Alarms (R41,200)

These alarms are global to the SITRANS LUC500 and can be detected through Modbus.

| Bit # | Description | Remote Access |
|---|---|---|
| 1 | Overflow (P169=1) | Read only |
| 2 | Underflow (P169=2) | Read only |
| 3 | Power Loss (P519=1) | Read only |
| 4-15 | Reserved | |
| 16 | Global Pump Reset Control | Write only |

**Note:** Refer to *Parameter Reference* section for more details on how these alarms are triggered and reset.

# Point Status (R41,211 – R41,212)

The point status for each point can be read using R41,211 for point 1, and R41,212 for point 2. The bits can be read as:

Bit 0: point not in operation
Bit 1: failsafe timer expired
Bit 2: cable shorted, open or transceiver failure
Bit 3: temperature sensor failed
Bit 13: emptying
Bit 14: filling

# Pump Control (R41,400 – R41,474)

Only relays set for pump control (P111 = 50 to 56) are available. These registers have no effect on relays programmed for other uses.

# Control and Status Word (R41,400 – R41,404)

Each Pump relay has a corresponding control and status word listed in the following registers.

| Pump Relay | Register |
|---|---|
| 1 | 41,400 |
| 2 | 41,401 |
| 3 | 41,402 |
| 4 | 41,403 |
| 5 | 41,404 |

Read and write the bits individually using a SCADA or HMI tool. When appropriate, the corresponding SITRANS LUC500 parameter is listed. See SITRANS LUC500 *Parameter Reference* on page 171 for full parameter details.

| Bit # | Description | Read / Write |
|---|---|---|
| 1 | Pump available (P520) | Read only |
| 2 | Pump in Local Auto (P521) | Read only |
| 3 | Pump in Local Manual (P522) | Read only |
| 4 | Pump in Remote Auto (P523) | Read only |
| 5 | Pump in Remote Manual (P524) | Read only |
| 6 | Local Auto discrete input | Read only |
| 7 | Run Status discrete input | Read only |
| 8 | Fault A discrete input | Read only |
| 9 | Fault B discrete input | Read only |
| 10 | Fault C discrete input | Read only |
| 11 | Pump Relay State | Read only |
| 12 | Remote Control Enable (P515) | Read / Write |
| 13 | Remote Auto | Read / Write |
| 14 | Remote Start | Read / Write |
| 15 | Remote Stop | Read / Write |
| 16 | Pump Failed (P510) | Read / Write |

# Status Bits

### Pump Available (bit 1) (Read Only)

Indicates whether the pump is available to the SITRANS LUC500 pump control routines. Mirrors the value of P520.

When operating normally pumps are always available. The pump can become unavailable if it is put into **manual** mode, if there is a detected pump fault through the discrete inputs, or if there is a power failure to the pumps.

0 = no 1 = yes

### Pump in Local Auto (bit 2) (Read Only)

Indicates that the indexed pump is exclusively controlled through the SITRANS LUC500 pump control algorithms. Mirrors the value of P521.

0 = no 1 = yes

### Pump in Local Manual (bit 3) (Read Only)

Indicates that the indexed pump is exclusively controlled from a discrete input. Usually a three-way (on-off-auto) switch mounted near the SITRANS LUC500 is used to put the unit into Local Manual mode and to control the pump. Mirrors the value of P522.

0 = no 1 = yes

### Pump in Remote Auto (bit 4) (Read Only)

Indicates that control of the indexed pump is from the SITRANS LUC500 pump control algorithms. See the SITRANS LUC500 *Parameter Reference* section for a description of the pump control algorithms. The remote system can put the pump into manual mode. This is done by writing to bits 12 and 13 of the Status and Control register. Mirrors P523.

0 = no 1 = yes (b12=1, b13=1)

### Pump in Remote Manual (bit 5) (Read Only)

Indicates that the indexed pump is exclusively controlled through communications from a remote system. This is done by writing to bits 12 and 13 of the Status and Control register.

To control the pumps use bits 14 and 15.

0 = no 1 = yes (b12=1, b13=0)

### Auto / Manual Discrete Input (bit 6) (Read Only)

Indicates the current status of any discrete input that is allocated to this pump for Local Auto operation.

0 = pump is in manual mode 1 = pump is in local auto mode

### Run Status Interlock (bit 7) (Read Only)

Indicates if the pump running interlock is active (the pump is running).

0 = no 1 = yes

### Pump Relay State (bit 11) (Read Only)

Status of the pump.

This bit reports the status of the pump relay. The pump control function can be asserted (pump running) or not (pump idle).

0 = pump not asserted 1 = pump asserted

### Pump Failed Status (bit 16)(Read/Write)

Reports on the status of the indexed pump with the value from P510 and allows the alarm to reset.

P510 is a latched parameter. It is set to 1 as soon as a pump error event is detected by the SITRANS LUC500 and must be reset to 0 using the hand programmer or a Global Reset before the pump will be included in the control algorithms. It can be reset using remote communications by writing a 1 to bit 12, and a 0 to bit 16 (hex value of 1800). See the SITRANS LUC500 *Parameter Reference* section for more information on P510.

0 = normal operation 1 = pump failed

## Control (Read / Write) Bits

Control bits can be set by writing the desired value. The value can also be read to determine the current status of the functions and operations of the SITRANS LUC500. For example, the SITRANS LUC500 can be in four different states of operation: Remote Manual, Remote Auto, Local Auto, and Local Manual. These control bits are used to switch modes. Also, when the SITRANS LUC500 is in the remote manual mode, the control bits can start and stop the pumps.

### Remote Control Enable (bit 12)

Sets the SITRANS LUC500 to accept commands from a remote system.

If there is a discrete input configured as a local / remote switch (P501≠ 0), then this value becomes read only and it mirrors the value of the switch. If there is no discrete input configured (P501= 0), then this bit is writeable. It then must be set to **1** to allow for remote control of the pump through the subsequent control bits. As preset, this value is writeable.

The SITRANS LUC500 can always provide data to remote systems but requires the setting of this bit to accept remote control of the referenced pump relay.

0 = pump in local only 1 = pump available for remote control

### Remote Auto / Manual (bit 13)

Sets the SITRANS LUC500 control algorithms on or off.

The remote control enable bit (12) must be set to **1** before writing this bit.

| | |
|---|---|
| 0 = Manual | all control functions must come from the remote system |
| 1 = Auto | control algorithms work normally but can be overridden by the remote system |

### Remote Start (bit 14)

Sends a command to the indexed pump to start.

This is a momentary control bit. Write **1** to the bit to issue the command. Do not read the bit. The bit always displays **0**.

Both the remote control enable bit (12) and the remote auto / manual bit (13) must be set to **1** before writing this bit.

1 = pump commanded to start

### Remote Stop (bit 15)

Sends a command to the indexed pump to stop.

This is a momentary control bit. Write **1** to the bit to issue the command. Do not read the bit. The bit always displays **0**.

Both the remote control enable bit (12) and the remote auto / manual bit (13) must be set to **1** before writing this bit.

1 = pump commanded to stop

# Pump Faults (R41,410 – 41,414)

Each pump relay has a corresponding fault word listed as follows.

| Pump Relay | Register |
|---|---|
| 1 | 41,410 |
| 2 | 41,411 |
| 3 | 41,412 |
| 4 | 41,413 |
| 5 | 41,414 |

Each relay has four bits that correspond to fault status as follows:

| Bit # | Description | Read / Write |
|---|---|---|
| 1 | Pump Fault A (P513) | Read only |
| 2 | Pump Fault B (P514) | Read only |
| 3 | Pump Run Status Fault (P511) | Read only |
| 4 | Pump Low Flow Fault (P512) | Read only |
| 5 | Pump Fault C (P516) | Read only |

To read the fault bits:

| | |
|---|---|
| 0 = normal | no fault condition exists and the pump is operating normally |
| 1 = fault | a fault is detected and the pump is removed from the pump rotation and will not run (not guaranteed for pump low flow fault) |

### Pump Fault A

Indicates that the pump is reporting a fault through a discrete input.

### Pump Fault B

Indicates that the pump is reporting a fault through a discrete input.

### Pump Run Status Fault (P511)

Indicates that the pump is reporting a fault through a discrete input.

### Pump Low Flow Fault (P512)

Indicates that the calculated rate for the pump is not meeting the capacity setpoint. This usually indicates that the pump is not working properly.

### Pump Fault C

Indicates that the pump is reporting a fault through a discrete input.

# Pump ON Setpoint (R41,420 – R41,424)

The ON setpoint level (P112) for the referenced pump relay.

The setpoint is scaled from 0 to 10,000 (0 to 100% of span multiplied by 100). So 54.02% is shown in the register as 5402.

# Pump OFF Setpoint (R41,430 – R41,434)

The OFF setpoint level (P113) for the referenced pump relay.

The setpoint is scaled from 0 to 10,000 (0 to 100% of span multiplied by 100). So 54.02% is shown in the register as 5402.

# Pumped Volume (R41,440 – R41,443)

The pumped volume registers hold the current total for all of the pumps associated with a level point. These registers are available only if operation is set to pumped volume (P001 = 7).

These volumes can become very large. Therefore, two registers are used to hold the value. See *Unsigned Double Precision Integer (UINT32)* on page 158 for more information.

The value in the registers is given as an integer value but must be interpreted as having the number of decimals set in P633 LCD Totalized Decimal Position (0 to 3). Ensure that your software accounts for these decimal places before you report the pumped volume totals.

# Pump Hours (R41,450 – R41,459)

The number of running hours for the referenced pump relay. The hours are given to three decimal places, so the UINT32 value must be divided by 1000 to get the correct value. For example 12,340 represents 12.34 hours.

Two registers are used to hold the value. See *Unsigned Double Precision Integer (UINT32)* on page 158 for more information. This value comes from parameter P310. See *P310 Pump Hours* on page 211 for details.

# Pump Starts (R41,470 – R41,474)

The number of pump starts for the referenced pump relay. This value comes from parameter P311. See *P311 Pump Starts* on page 211 for details. R41,470 is the register for pump 1, R41,471 is the register for pump 2, etc.

# Pump Capacity (R41,480 – R41,484)

The calculated pump capacity for the referenced pump relay. The value is scaled from 0 to 20,000 (0 to 200% multiplied by 100).

This value comes from parameter P182. See *P182 Pump Measured Capacity* on page 200 for details. R41,480 is the register for pump 1, R41,481 is the register for pump 2, etc.

# Parameter Access (R43,998 – R46,999)

Parameter values are given as integers in the range of registers from R44,000 to R44,999. The last three numbers of the register correspond to the parameter number.

| Parameter Register # | Format Register # | Parameter # |
|---|---|---|
| 44,000 | 46,000 | P000 |
| 44,001 | 46,001 | P001 |
| 44,002 | 46002 | P002 |
| … | … | … |
| 44,999 | 46,999 | P999 |

Usually, the parameters are all read / write.

**Note:**

- Format registers are located in RAM memory and are cleared after a program download or a power cycle. If P000 is set to **lock activated** then all of the parameters are read only.
- Parameter P999 (Master Reset) cannot be used via Modbus.
- See *Data Types* on page 158 for a description of the different types of data associated with different parameters.

Each parameter register has a corresponding format register that holds the format information required to interpret the value. See *Format Words (R46,000 to R46,999)* on page 149.

# Parameter Indexing

Many parameters are indexed. There are two possible indexes: a primary index and a secondary index. A secondary index is a sub-address of the primary index. Some indexed parameters affect multiple I/O devices.

The following is an example of a primary index: P111 is the Relay Control Function and determines how a relay is controlled by the SITRANS LUC500. Because there are five relays on the SITRANS LUC500, P111 is indexed by five allowing each relay to be programmed independently.

A few parameters also have a secondary index. While a secondary index is important for setting up the SITRANS LUC500, it is almost never needed through remote communications.

## Indexing the Parameter Access Area

Each parameter communicates its value to only one register. You must know the index(es) for the parameter in order to interpret the information in the register correctly.

For example, the value returned in register R44,111 is useless unless you know to which relay it refers. See *Relay Function Codes (P111 Only)* on page 160 for details on P111 values.

To determine the index values, the primary and secondary index must be read or write. The two possible methods of handling these index values are described in the following paragraphs: *Global Index Method* and *Parameter Specific Index Method*.

# Reading Parameters

To read parameter values, follow the steps listed in either the Global or the Parameter Specific Index Method that follow. You must be able to program your HMI or SCADA system before completing these methods.

## Global Index Method (P782 = 0)

Global format method sets index values for all parameters simultaneously. Use this method to read multiple values set to the same index values.

1. Write the primary index value into R43,999.

This is a value between **0** and **40** which specifies the input or output indexed by the parameter.

Examples:

- Transducer 1 is index 1
- Discrete input 8 is index 8
- Relay 5 is index 5

2. Write the secondary index value into R43,998.

This is a value between **0** and **40** that specifies the secondary index on the parameter. This value is usually **0**.

3. Write the desired format value into the appropriate format register.

Because the primary and secondary indexes are already specified, these portions of the format word are ignored and only the last digit is significant. See *Format Register* on page 165 for details.

4. Read the value from the appropriate parameter register.

Types of values are:
- *Numeric Values* on page 158
- *Bit Values* on page 158
- *Split Values* on page 159
- *Text Messages* on page 160
- *Relay Function Codes (P111 Only)* on page 160

A value of 22,222 means an error has occurred. Specify a different format type and try again.

## Parameter Specific Index Method (P782 = 1)

The Parameter Specific index method sets the index values for each parameter independently. Use this method to read multiple parameters with different index values.

1. Write the primary index, secondary index, and data format values into the appropriate format register.

For example, to read the following information:

- measured level (P921)
- in units with three decimal places
- from transducer one
  – send the integer value 01008 to register 46,921. Send integer value **28**; the leading zeros are assumed (see *Format Register* on page 149 for details)

Modbus Register Map

2. Read the value from the appropriate parameter register (the example uses 44,921).

Types of values are:

- *Numeric Values* on page 158
- *Bit Values* on page 158
- *Split Values* on page 159
- *Text Messages* on page 160
- *Relay Function Codes (P111 Only)* on page 160

A value of 22,222 indicates that an error occurred. Specify a different format type and try again.

## Writing Parameters

The method of writing parameters is similar to the method of reading them. Become familiar with *Reading Parameters* (page 148) before attempting to write any parameters.

To write parameter values to the SITRANS LUC500, follow these steps:

### Global Index Method (P782 = 0)

1. Write the primary index value into R43,999.
2. Write the secondary index value into R43,998.
3. Write the desired format value into the appropriate format register.
4. Write the value to the appropriate parameter register.

### Parameter Specific Index Method (P782 = 1)

1. Write the primary index, secondary index, and data format values into the appropriate format register.
2. Write the value to the appropriate parameter register.



# Format Registers (R46,000 to R46,999)

Format registers are unsigned integers that contain up to three items of information (described below). The number of values used in the format words depends on the Parameter Index Location (P782) that is used.

*Parameter P782 Parameter Index Location* (page 132), determines which of two methods is used to access the format words: Global Index Method or Parameter Specific Index Method.

## Global Index Method (P782 = 0)

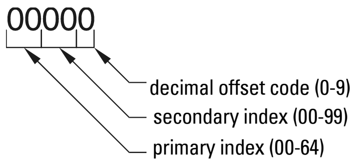
Only the decimal offset segment of the format word is used.

## Parameter-Specific Index Method (P782 = 1)

All three decimal fields are used to determine the parameter value's primary index, secondary index, and decimal offset.

# Format Registers

Each format register is made up of three decimal fields: a decimal offset code, secondary index, and primary index




The primary and secondary indices correspond to those that are used by the parameter.

The decimal offset code indicates how the remote system will view the SITRANS LUC500 parameter value in the parameter access register. The following table shows how the SITRANS LUC500 parameter value of **1.23** is written in the parameter access register in the Modbus Map. So, when the decimal offset code is set to **0**, the value **1.23** will be written to the Modbus Map as **1** (with no decimals).

| Decimal Offset Code | Meaning | Register |
|---|---|---|
| 0 | register value is displayed as integer | 1 |
| 1 | decimal moves 1 position to the right | 12 |
| 2 | decimal moves 2 positions to the right | 123 |
| 3 | decimal moves 3 positions to the right | 1230 |
| 4 | decimal moves 4 positions to the right | 12300 |
| 5 | decimal moves 5 positions to the right | 32767[1] |
| 6 | decimal moves 1 position to the left | 0 |
| 7 | decimal moves 2 positions to the left | 0 |
| 8 | decimal moves 3 positions to the left | 0 |
| 9 | displays value as a percent | variable |

1. Register value is greater than 20,000 and so displays value 32767 (see *Text Messages* on page 160 for more information).

Another example shows how the SITRANS LUC500 parameter value of 1954 is written in the parameter access register in the Modbus map. So, when the decimal offset code is set to 6, the value 1954 will be written to the Modbus Map as 195.

| Decimal Offset Code | Meaning | Register |
|---|---|---|
| 0 | register value is displayed as integer | 1954 |
| 1 | decimal moves 1 position to the right | 19540 |
| 2 | decimal moves 2 positions to the right | 32767[1] |
| 3 | decimal moves 3 positions to the right | 32767 |
| 4 | decimal moves 4 positions to the right | 32767 |
| 5 | decimal moves 5 positions to the right | 32767 |
| 6 | decimal moves 1 position to the left | 195 |
| 7 | decimal moves 2 positions to the left | 19 |
| 8 | decimal moves 3 positions to the left | 1 |
| 9 | displays value as a percent | variable |

1. Register value is greater than 20,000 and so displays value 32767 (see *Text Messages* on page 160 for more information).

Examples of using the format word for both the index values and the decimal offset value are shown below:

| Format register | P. Index | S. Index | Decimal |
|---|---|---|---|
| 00000 | 00 | 00 | 0 |
| 01003 | 01 | 00 | 3 right |
| 02038 | 02 | 03 | 3 left |
| 05159 | 05 | 15 | percent |

To write these values you can use a decimal offset as follows: format register = (primary index x 1000) + (secondary index x 10) + (decimal).

### Time and Date

Because the time and date values do not fit into a single register, they are indexed on the secondary index.

| Index | Date | Time |
|---|---|---|
| 01 | yy – year | hh – hour |
| 02 | mm – month | mm – minute |
| 03 | dd – day | ss – second |

Because the time and date values use three index entries, they cannot be accessed for parameters that already have a primary and secondary index. These parameters are:

- Overflow Logging
- Profile Records
- TVT Shaper



## Report by Exception (R49,250 – 49,259)

See *Report by Exception* on page 72.

## Data Log Values (R49,500 – 49,730)

Data logging is available only with the optional expansion memory. There are 10 user defined data logs (1 to 10) and each data log can hold 5,000 data entries. See also *Data Logging* on page 79.

There is also an alarm Log, which is Log 0. Any trigger configured as an alarm to be logged (P430) will be logged in this section. Both the rising and trailing edges of the trigger will be logged. This log is not the same as the data logs.

**Note:** The preferred method of reading entire data logs is described in *Data Log File Transfer (R49,800 – R49,899)* on page 154.

# Format of Information

The Data Log section is divided up into several different sections:

| Section | Register Range | Description | Reference Parameter |
|---|---|---|---|
| Last Logged Information | 49,500 – 49,559 | Contains the value, time, trigger state, and number of entries for logs 1 to 10. | P450 – P453 |
| Reset Logs | 49,668 – 49,677 | Used to reset users logs 1 to 10. Place a 1 in the correct register and the log is cleared. | P447 |
| Data Record Access | 49,700 – 49,706 | Hand shaking area used to request any record of logs 0 to 10 (this section includes access to the alarm log). | N/A |
| Log Statis-tics Access | 49,710 – 49,717 | Hand shaking area used to request the log statistics for any of the user logs 1 to 10 (does not include the alarm log). | P454 – P 458 |
| Last Alarm Logged | 49,720-49,724 | Contains the trigger number, time, and trig-ger state of the most current alarm. It also contains the total number of entries in the alarm log. | P432 – P435 |
| Alarm Reset | 49,730 | Placing a 1 in this register will reset the alarm log. | P431 |

## Lasted Logged Information (R49,500 – 49,559)

| Registers | Description | Range | Units |
|---|---|---|---|
| R49,500-49,501 | Value for log 1 (3 decimal places) | Depends on parameter | UINT32 |
| R49,502-49,503 | Time for log 1 | In seconds from Jan 1, 1970 | UINT32 |
| R49,504 | Trigger state that causes data capture | 0 or 1 | UINT |
| R49,505 | Number of entries for log 1 | 0 to 5,000 | UINT |
| R49,506 –49,511 | Data for log 2[1] | | |
| R49,512-49,517 | Data for log 3 | | |
| R49,518 – 49,523 | Data for log 4 | | |
| R49,524 – 49,529 | Data for log 5 | | |
| R49,530 – 49,535 | Data for log 6 | | |
| R49,536 – 49,541 | Data for log 7 | | |
| R49,542 – 49,547 | Data for log 8 | | |
| R49,548 – 49,553 | Data for log 9 | | |
| R49,554 – 49,559 | Data for log 10 | | |

1. The data for logs 2 through to 10 is the same format as log 1. The data repeats for each log.

## Reset Logs (R49668 – R49677)

When a value of 1 is placed in these registers, the corresponding log file is cleared.

| Register | Log that is reset |
|---|---|
| R49,668 | Reset log 1 |
| R49,669 | Reset log 2 |
| R49,670 | Reset log 3 |
| R49,671 | Reset log 4 |
| R49,672 | Reset log 5 |
| R49,673 | Reset log 6 |
| R49,674 | Reset log 7 |
| R49,675 | Reset log 8 |
| R49,676 | Reset log 9 |
| R49,677 | Reset log 10 |

## Data Record Access Area (R49,700 – 49,706)

This area of memory provides a method to retrieve any single log entry out of all the log files (Log 0 to 10). It works in a similar way to Single Parameter Access (SPA), in that you provide the log file number and the entry number, and the SITRANS LUC500 will write the entry number, entry value, entry time, and trigger state into the registers.

**Note:** If you want to read the entire data log as one file see *Data Log File Transfer (R49,800 – R49,899)* on page 154.

| Register | Description | Values | Read/write | units |
|---|---|---|---|---|
| R49,700 | Log file number | 0 to 10 | R/W | UINT |
| R49,701 | Entry number | 1 to 5000 | R/W | UINT |
| R49,702-49,703 | Entry value | (3 fixed decimal places – see UINT32 section) | R | UINT32 |
| R49,704-49,705 | Entry Time | (time since Jan. 1, 1970 – see appendix C) | R | UINT32 |
| R49,706 | Trigger state | 0 or 1 | R | UINT |

## Log Statistics (R49,710 – R49,717)

This area of memory provides a method to retrieve the statistical information on a data log (Log 1 to 10). It works in a similar way to Single Parameter Access (SPA) in that you provide the log file number and the statistical type (see below), and then the SITRANS LUC500 will write the average, minimum, and maximum value.

| Register | Description | Values | Read/write | units |
|---|---|---|---|---|
| R49,710 | Log file number | 1 to 10 | R/W | UINT |
| R49,711 | Statistical type | 0 to 10 | R/W | UINT |
| R49,712-49,713 | Average value | (3 decimal places see UNIT32 section) | R | UINT32 |
| R49,714-49,715 | Minimum value | (3 decimal places see UNIT32 section) | R | UINT32 |
| R49,716-49,717 | Maximum value | (3 decimal places see UNIT32 section) | R | UINT32 |

The types of statistics are listed below:

**Statistics Type (Write Value)**

0 – current trigger period stats
1 – current hour stats
2 – current day stats
3 – current week stats
4 – current month stats
5 – previous hour stats
6 – previous day stats
7 – previous week stats
8 – previous month stats
9 – previous 60 minutes
10 – previous 24 hours

**Note:** Statistics Type 9 and 10 require considerable computation; therefore, we do not recommend using them with communications.

## Last Alarm (R49,720 – 49,724)

This gives the latest alarm information. It also gives the total number of entries in the alarm log.

| Register | Description | Values | Read/write | Units |
|---|---|---|---|---|
| R49,720 | Last alarm trigger | 1-32 | R | UINT |
| R49,721-49,722 | Time stamp | Time in seconds from Jan. 1, 1970 | R | UINT32 |
| R49,723 | Trigger state | 0 or 1 | R | UINT |
| R49,724 | Number of entries | 0 to 5000 | R | UINT |

### Alarm Reset (R49,730)

When a value of 1 is placed in this register, the alarm log is cleared.

# Data Log File Transfer (R49,800 – R49,899)

Data logs can be downloaded one value at a time, or one file at a time. The complete file method of downloading data logs is more efficient when you need more than one or two values and is the preferred method for downloading the entire data log.

**Note:** For a sample procedure on using the file method see Communication *Communication Appendix C: Reading Data Log Files* on page 168.

## Open a Data Log File (R49,800 – R49,809)

Use these registers to set up a download operation for a data log.

## File Number (R49,800)

Set to 220.

## Function Code (R49,801)

Requests an action:

| Function Code | Description |
|---|---|
| 1 | Open file for reading |
| 3 | Close file when finished |

Use **1** when you are preparing the SITRANS LUC500 to present the data log file. The register will remain set to **1** during the entire file transfer.

Use **3** when you want to close the file. When the file is closed the SITRANS LUC500 changes R49,801 to **4**.

If you attempt to open a data log file without closing the previous one you will get a return code of **11** in R49,807.

## Maximum Segment Length (R49,802)

Set to 160.

## Response Code (R49,807)

The SITRANS LUC500 can respond to the request with the following codes:

| Response Code | Description |
|---|---|
| 0 | All OK, requested action is being performed |
| 2 | The function code in R49,801 is invalid |
| 9 | The file number in R49800 is not 220 |
| 11 | The port for file transfer is already open (in use) |

## Data Log Number (R49,808)

This specifies the data log (1 to 10) that you want to download. If the data log does not exist, you will get undefined results.

There is also an error log (log 0) available for download.

## Initiate Changes (R49,809)

Write a 1 in this register to act on the values in R49,800, R49,801, R49,802 and R49,808. After you write a 1 here, look to R49,807 for the return code.

# Transfer a Data Log File (R49,810 – R49,899)

Use these registers to download data logs in 160-byte (80-register) chunks.

## File Number (R49,810)

Set to 220.

## Function Code (R49,811)

Set to 0.

## Offset Byte Number (R49,814 – R49,815)

Increment this number by 160 every time you read registers R49,820 to R49,899. Each register is 2 bytes, so the 80 registers become 160 bytes for the offset.

**Notes:**

- You can specify numbers other than multiples of 160 but then you will either be missing data or duplicating it. If you do this, remember that a change of two in the value (bytes) equals a shift of one register for the data. For this reason, never use odd numbers for this value.
- The 32-bit integer in R49,814 and R49,815 always has a small value. You can write a 16-bit integer to the least significant word (LSW) if that saves you time. See Word Order (R40,062) on page 137 to check which word order the UINT32 data type uses.

Every time you change this value the SITRANS LUC500 immediately updates the data in registers R49,820 to R49,899 to reflect the next block of data in the data log.

The block size register (R49,819) is also updated. When this value shows as smaller than 160 you know that you are looking at the last block of data from the specified data log.

## Response Code (R49,816)

The SITRANS LUC500 can respond to the request with the following codes:

| Response Code | Description |
|---|---|
| 0 | All OK, data is in registers R49,820 to R49,899 |
| 9 | The file number in R49810 is not 220 |

## Block Size (R49,819)

This value shows the number of bytes being presented in registers R49,820 to R49,899. If the value is 160 then there is still more data left in the log to download. If the value is less than 160 then this is the final block of data.

Your program should read R49,819 and continue reading or close the file based on the value.

## Data (R49,820 – R49,899)

The values in the data log. This is binary data presented in a block of registers.

### Data Log File Structure

The Data Log File has three sections:

- File Header – contains information about the file
- Data Log Header – contains information about the data log
- Data – the tracked values

The data in the transferred file does not adhere to the register boundaries imposed by Modbus. Treat the entire data stream as a binary file with the following structure.

### File Header

| Field | Data Type | Description |
|---|---|---|
| Block Type and rev. | UINT16 | Internal Siemens Milltronics information |
| Offset to data | UINT8 | Number of bytes to first data field – should always be 5 |
| Date / Time Stamp | UINT32 | Number of seconds since Jan 1, 1970 |
| Number of log files | UINT8 | Always 1 |

### Data Log Header

| Field | Data Type | Description |
|---|---|---|
| Block Type and rev. | UINT16 | Internal Siemens Milltronics information |
| Offset to data | UINT8 | Number of bytes to first data field – should always be 9 |
| Data Log Number | UINT8 | Number of the data log, primary index of P441 |
| Logged Parameter | UINT16 | Parameter tracked in the data log, value of P441 for the given index |
| Logged Index | UINT8 | Primary index of the logged parameter, value of P442 |
| Data Type | UINT8 | Either 6 or 10, see chart below |
| Data Time Span | UINT8 | Either instantaneous or averaged, shows the value of P443 – Data Type |
| Log Status | UINT8 | Status of the trigger that caused an entry to be written to the log as P453 – Log Status |
| Number of Records | UINT16 | Number of data records in the file, can be 0 to 5000 |

### Data

| Field | Data Type | Description |
|---|---|---|
| Record Number | UINT16 | Internal record (0 to 4999) |
| Value | INT32 | Value of logged parameter in units as defined in the Data Log Header |
| Date / Time Stamp | UINT32 | Number of seconds since Jan 1, 1970 |
| Trigger Status | UINT8 | Status of trigger that caused data log capture – useful when you are logging on both trigger activation and negation |

### Data Types

There are two possible data types used in the SITRANS LUC500 data logs:

| Type | Data Type | Description |
|---|---|---|
| 6 | INT32 | 32-bit signed integer (see page 159 for details) |
| 10 | Adjustable Float | Float x 1000 converted to an integer |

# Data Types

The SITRANS LUC500 parameters do not always use integers to hold values. For the convenience of the programmer, those values are converted to and from a 16-bit integer number. This section describes the conversion process. The sections that follow describe where those values are in the discrete I/O and block transfer addresses, and how to get the parameters you need.

# Numeric Values

Numeric parameter values are the most common. For example, parameter P920 (Reading) returns a number that represents the current reading (either level or volume, depending on the SITRANS LUC500 configuration).

Numeric values are requested or set in units or percent of span, and may be specified with a number of decimal places.

Numeric values must be in the range -20,000 to +20,000 to be valid. If a parameter is requested and its value is more than +20,000, the number 32,768 is returned; if it is less than -20,000, the number -32,768 is returned. If this overflow happens, decrease the number of decimal places.

If a parameter cannot be expressed in terms of percent of span, or has no meaningful value, the number 22,222 is returned. Try requesting the parameter in units, or refer to the *P005 Units* on page 174.

# Bit Values

Bits are packed into registers in groups of 16 bits (1 word). In this manual, the bits are numbered from 1 to16, with bit 1 as the least significant bit (LSB) and bit 16 as the most significant bit (MSB).

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

MSB LSB

# Unsigned Double Precision Integer (UINT32)

Large numbers are put into unsigned 32 bit integers. By default, they are set up so that the first word (register) is the most significant word (MSW) and the second word (register) is the least significant word (LSW).

For example, if R41,442 is read as a UINT32, the 32 bits would look like this:

| R41,442 | | | R41,443 | | |
|---|---|---|---|---|---|
| 16 | MSW | 1 | 16 | LSW | 1 |
| 32 | 32-bit integer value (UINT32) | | | | 1 |

The two registers are read as a 32-bit integer.

The most significant word (MSW) and least significant word (LSW) can be reversed to accommodate some Modbus drivers. See *Word Order (R40,062)* on page 137 for details.

Data Types

The position of the decimal place is depended on the register. For more details see the description of the register.

A fixed 3 decimal places means that a number of 234567 in a register means 234.567.

# Signed Double Precision Integer (INT32)

Large, signed numbers are put into signed 32 bit integers. By default, they are set up so that the first word (register) is the most significant word (MSW) and the second word (register) is the least significant word (LSW).

For example, if data from a data log header is read as an INT32, the 32 bits would look like this:

| | | | | | |
|---|---|---|---|---|---|
| 16 | MSW | 1 | 16 | LSW | 1 |
| 32 | 32-bit signed integer value (INT32) | | | | 1 |

The two registers are read as a 32-bit signed integer with potential values from -2,147,483,648 to 2,147,483,647.

The most significant word (MSW) and least significant word (LSW) can be reversed to accommodate some Modbus drivers. See *Word Order (R40,062)* on page 137 for details.

# Split Values

Certain parameters are actually a pair of numbers separated by a colon, using this format: xx:yy.

One example is P807, Transducer Noise, where:

xx = the average noise value in dB.
yy = the peak noise in dB.

The number which corresponds to xx:yy, either for reading or setting a parameter, is determined by the following formula:

**For storing to the Siemens Milltronics device:**

value = xx + 128) x 256 + (yy + 128)

**For reading from the Siemens Milltronics device:**

xx = (value / 256) – 128
yy = (value % 256) – 128

Where:

% is the modulus operator.

The modulus can be computed by following these steps:
$value_1$ = value / 256
$value_2$ = remainder of $value_1$
$value_3$ = $value_2$ x 256
yy = $value_3$ – 128

It may simplify Parameter to notice:

xx = (most significant byte of value) – 128

yy = (least significant byte of value) – 128

Data Types

# Text Messages

If a Siemens Milltronics device parameter returns a text message, that message is converted to an integer and provided in the register. The numbers are shown in the following table:

| Number | Text Message as displayed on LCD |
|---|---|
| 22222 | Invalid value |
| 30000 | Off |
| 30001 | On |
| 30002 | ≡ ≡ ≡ ≡ |
| 30003 | [ - - ] (parameter does not exist) |
| 30004 | Err |
| 30005 | Err1 |
| 30006 | Open |
| 30007 | Short |
| 30008 | Pass |
| 30009 | Fail |
| 30010 | Hold |
| 30011 | Lo |
| 30012 | Hi |
| 30013 | De |
| 30014 | En |
| 30015 | (parameter has not been set) |
| -32768 | Value is less than -20,000 |
| 32767 | Value is greater than 20,000 |

# Relay Function Codes (P111 Only)

Data Types

If a Siemens Milltronics device parameter returns a relay function code, that message is converted to a number and is then provided in the register. The numbers are shown in the following table:

| Relay function Code | Number | P111 |
|---|---|---|
| Off, relay not used | 0 | 0 |
| Undesignated Level Alarm | 1 | 1 |
| Low-Low Level Alarm | 2 | 1 – LL |
| Low Level Alarm | 3 | 1 – L |
| High Level Alarm | 4 | 1 – H |
| High-High Level Alarm | 5 | 1 – HH |
| In Bounds Alarm | 6 | 2 |
| Out of Bounds Alarm | 9 | 3 |
| Rate of Level Change Alarm | 12 | 4 |
| Temperature Alarm | 15 | 5 |
| Loss of Echo (LOE) Alarm | 20 | 6 |
| Transducer Cable Fault Alarm | 16 | 7 |
| Pump Efficiency Alarm | 17 | 8 |

| Relay function Code (con't) | Number | P111 |
|---|---|---|
| Clock Failure Alarm | 18 | 9 |
| Time of Day Alarm | 19 | 10 |
| Pump Failure Alarm | 70 | 11 |
| Power Failure Alarm | 71 | 12 |
| Totalizer | 22 | 40 |
| Flow Sampler | 23 | 41 |
| Fixed Duty Assist | 25 | 50 |
| Fixed Duty Backup | 26 | 51 |
| Alternate Duty Assist | 30 | 52 |
| Alternate Duty Backup | 31 | 53 |
| Service Ratio Duty Assist | 35 | 54 |
| Service Ratio Duty Backup | 36 | 55 |
| First In First Out (FIFO) | 40 | 56 |
| Time | 45 | 60 |
| Overflow | 50 | 61 |
| Aeration | 55 | 62 |
| Gate | 60 | 63 |
| Flush Valve | 65 | 64 |
| Communication | 66 | 65 |

See the *P111 Relay Control Function* on page 184 for information on P111.

# Modems

The Modbus protocol will work with many types of modems but we suggest using an industrial grade modem. Typically, industrial grade modems will last longer than commercial grade modems in industrial applications with the SITRANS LUC500.

For dial-up applications, Siemens Milltronics offers quick and easy connection to the SITRANS LUC500 with the External Modem Kit. Please see our web site at **www.siemens.com/processautomation** for more information.

For information about non-dial-up applications, application guides are available on our web site at **www.siemens.com/processautomation**.

## Modbus Responses

When polled by a Modbus Master, a slave device will do one of the following:

1. Not reply. Which means that something went wrong with the transmission of the message.
2. Echo back the command with the correct response (see the Modbus specification for more details). This is the normal response.
3. Return an Exception Code. This reflects an error in the message.

SITRANS LUC500 uses the following exception codes:

| Code | Name | Meaning |
|---|---|---|
| 01 | Illegal Function | The function code received in the query is not an allowable action for the slave. |
| 02 | Illegal Data Address | The data address received in the query is not an allow-able address for the slave. |
| 03 | Illegal Data Value | A value contained in the query data field is not an allowable value for the slave. |

## Error Handling

Errors can be traced to two general sources:

1. There is an error in transmission. OR
2. The host tries to do something that is not a valid action.

In the first case, the SITRANS LUC500 does not respond and the master waits for a response time out error, which causes the master to re-send the message.

In the second case, the response depends on what the host tries to do. In general, SITRANS LUC500 will not give an error to the host request. Various actions and the expected outcome are as follows:

- If the host reads an invalid register, the host will get an undetermined value back.
- If the host writes an invalid register (a non-existing parameter or a read only parameter), the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the host writes a read only register, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If P000 is activated, then the value will be ignored and no error response will be made. However, the current value will not reflect the desired new value.
- If the host attempts to write one or more registers that are out of range, an exception response code 2 or 3 is generated depending if the start address is valid.
- If the host attempts to read one or more registers that are out of range, an exception response code of 2 or 3 is generated.
- If the host used an unsupported function code, an exception response code of 01 should be generated. However, this is not guaranteed and there may be no response.

# Communication Troubleshooting

## Generally

1. Check to see that:
   - There is power at the unit
   - The LCD is showing the relevant data
   - The device can be programmed using the hand programmer
2. Check the wiring pin outs and verify that the connection is correct.
3. Go over the set-up parameter P770 to P779 and verify that these values match the settings in the computer that you are using to communicate with it.
   Verify that P766 (Communications Lock) is set to 0 for the port you are using. If P766 is set to any other number, the communication lock will be active and you will have to unlock the unit. To unlock the unit and allow normal read and writes, write the PIN number stored in P767 to register 40, 061.
4. Check that the port you are using on the computer is correct. Sometimes trying a different Modbus driver will solve the problem. An easy stand-alone driver called ModScan32 is available from Win-Tech at www.win-tech.com. We have found that this driver is useful to test communications.

## Specifically

1. You have set up an SITRANS LUC500 to talk over a modem but you are not getting any communication back to the master.
   - Check that the parameters are set up correctly and that you have configured the correct port. The RS-232 port on the terminal strips of the SITRANS LUC500 is port 2. This means that you must set P770, primary index 2, to the correct settings.
   - Check that you are using the correct wiring diagram. Note that there is a difference between wiring directly to a computer and wiring to a modem. A good check is to use an RS-232 null modem and cable, remove the modems from the picture, and then communicate directly. If this works, the problem is in the modem.
   - Verify that your modem is set up correctly. Siemens Milltronics has a series of Application Guides available on our web site at www.siemens.com/processautomation.
2. You try to set an SITRANS LUC500 parameter, but the parameter remains unchanged.
   - Some parameters can only be changed when the Siemens Milltronics device is not scanning. Try putting the Siemens Milltronics device in PROGRAM mode, using the operating mode function.
   - Try setting the parameter from the keypad. If it can not be set using the keypad, check the lock parameter and set it to 1954.
3. You are testing report by exception but nothing is happening.
   - Is the SITRANS LUC500 in RUN mode or PROGRAM mode? The triggers for report by exception will only occur if the unit is in RUN mode.

# Communication Appendix A: Single Parameter Access (SPA)



This Appendix is intended to provide someone with advanced communication knowledge the ability to access any parameter value in any available format.

An advanced handshaking area that can be used to read and write single registers to the SITRANS LUC500 is built in. This section performs a similar function as the Parameter access section. The differences are:

1. Advanced section is more powerful and harder to program.
2. Advanced section only gives you access to one parameter at a time.

## Mapping

Parameter Read and Write (40,090 – 40,097) is a series of eight registers used for reading and writing parameter values to and from the SITRANS LUC500. The first three registers are always unsigned integers representing parameters and index values. The second five registers are the format and value(s) of the parameter.

All parameters normally accessed through the hand-held programmer are available through these registers.

| Address | Description |
|---|---|
| 40,090 | Parameter (integer) |
| 40,091 | Primary Index (integer) |
| 40,092 | Secondary Index (integer) |
| 40,093 | Format word (bit mapped) |
| 40,094 | Read value, word 1 |
| 40,095 | Read value, word 2 |
| 40,096 | Write value, word 1 |
| 40,097 | Write value, word 2 |

# Reading Parameters

To read parameters through Modbus:

- Send the parameter, its primary index, and its secondary index (usually 0), and format to registers 40,090 to 40,093.
- Wait until you can read the written values from the registers (40,090 to 40,093) to confirm that the operation is complete.
- Read the value from registers 40,094 and 40,095.

# Writing Parameters

To set parameters through Modbus:

- Send the parameter, its primary index, and its secondary index (usually 0) to registers 40,090, 40,091, and 40,092.
- Write the value to registers 40,096 and 40,097.
- Write the desired format word to register 40,093 to enable the SITRANS LUC500 to interpret the value correctly.

# Format Register

| Bits | Values | Description |
|---|---|---|
| 1-8 | 0-2 | Error Code |
| 9-11 | 0-7 | 3-bit number representing decimal offset |
| 12 | 0/1 | direction of offset (0 = right, 1 = left) |
| 13 | 0/1 | Numeric format: Fixed (0) or Float (1) |
| 14 | 0/1 | Read or Write of data, Read (0), Write (1) |
| 15 | 0/1 | Word order: Most Significant Word first (0),Least Significant Word first (1) |
| 16 | | Reserved |



For example, to format the level reading so that it is shown in percent with two decimal places shifted left, the format bits would look like this:

| Bit Numbers | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit Values | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | reserved | most significant first | read | fixed format | offset direction to right | decimal offset of 2 | | | no error code | | | | | | | |

The value sent to the SITRANS LUC500 is 0001001000000000 binary or 4608 decimal. The value **4608** is sent as an integer to register 40,093 to format the output words 40,094 and 40,095 accordingly.

If the numeric data type is set for integer and the value contains decimal places, they are ignored. In this situation, use the decimal offset to ensure that you have an integer value and then write your code to recognize and handle the decimal offset.

# Error Codes

The error codes returned in the format area are 8-bit integers found in the lowest 8 bits of the format word. This allows for 256 potential error codes.

Currently the SITRANS LUC500 has two error codes available.

| Values | Description |
|---|---|
| 0 | No error |
| 1 | Data not available as percent (available as units) |
| 2-255 | Reserved |

# Communication Appendix B: Time Stamp Values



The time stamps are all in 32 bit integers that give the number of seconds from January 1, 1970. Below is an algorithm in Basic to convert to year, month, day, hour, minute, second.

```
Sub convert_time(real_time, ryrs,rmon,rday,rhrs,rmin,rsec)

Dim imin, ihrs, iday, iyrs, mday, jday, lday, qday As Long
Dim real_time, rsec, rmin, rhrs, rday, rmon, ryrs As Long
Dim datamon(14)

' real_time = time in seconds from Jan.1, 1970
' ryrs = year (r=real)
' rmon = month
' rday = day
' rmin = minute
' rsec = seconds
' imin, ihrs, iday, iyrs are all intermediate calculations (described below)
' lday = leap day
' qday = quad day
' jday = index counter of days (used to calculate rday)
' datamon = database of the # of days since the beginning of the year

' set up database of # of days since beginning of the year
datamon(1) = 0
datamon(2) = 31
datamon(3) = 59
datamon(4) = 90
datamon(5) = 120
datamon(6) = 151
datamon(7) = 181
datamon(8) = 212
datamon(9) = 243
datamon(10) = 273
datamon(11) = 304
datamon(12) = 334
datamon(13) = 365

'whole minutes since 1/1/70
imin = Int(real_time / 60)

'leftover seconds
rsec = real_time - (imin * 60)

'whole hours since 1/1/70
ihrs = Int(imin / 60)

'leftover minutes
rmin = imin - (ihrs * 60)
```

```
'whole days since 1/1/70
iday = Int(ihrs / 24)

'leftover hours
rhrs = ihrs - (iday * 24)

' whole days since 1/1/68
iday = iday + 365 + 366

' quadyr = 4 yr period = 1461 days
lday = Int(iday / ((4 * 365) + 1))

'days since current quadry began
qday = iday Mod ((4 * 365) + 1)

' if past feb 29 then add this quadyr's leap day to the # of quadyrs (leap
‘days) since 1968
If (qday >= (31 + 29)) Then lday = lday + 1

' whole years since 1968
iyrs = Int((iday - lday) / 365)

' days since 1/1 of current year
jday = iday - (iyrs * 365) - lday

' if past 29 and a leap year then add a leap day to the # of whole
If ((qday <= 365) And (qday >= 60)) Then jday = jday + 1

' compute years
ryrs = iyrs + 1968

' estimate month (+1)
rmon = 13

' max days since 1/1 is 365
mday = 366

'mday = # of days passed from 1/1
Do While (jday < mday)
    ' estimated month
    rmon = rmon - 1

'# elapsed days at first of mon
   mday = datamon(rmon)

'if past 2/29 and leap year then add leap day month until found
    If ((rmon > 2) And (ryrs Mod 4 = 0)) Then mday = mday + 1

Loop

' compute day of month
rday = jday - mday + 1

End Sub
```

Communication Appendix B

# Communication Appendix C: Reading Data Log Files

Data logs can either be read one value at a time or the entire log at once.

- If you only need one value from the log then see *Data Record Access Area (R49,700 – 49,706)* on page 153.
- If you need the entire log, follow the procedure outlined below.

## Procedure

The structure of data logs is described in *Data (R49,820 – R49,899)* on page 156. You will need to know how to interpret this structure once the binary data file is loaded on your PC.

Follow these steps to read a data log file.

1. Connect to the SITRANS LUC500 using Modbus
2. Write R49800 = 220
3. Write R49801 = 1 to open the file
4. Write R49802 = 160
5. Write R49808 = n (where n is the data log number you want to read)
6. Write R49,809 = 1
7. Read R49807 and ensure the return code is 0
8. Write R49810 = 220
9. Write R49811 = 0
   i = 0
10. Write R49,814 – R49815 = i (this is a UINT32)
11. Read R49816 and ensure the return code is 0
12. Read R49819 to get the number of bytes in the data block. This will be 160 when there are more data blocks to be read.
13. Read R49820 to R49899 in one read operation and append that data into a file
    i = i + 160
14. If R49819 = 160 loop back to step 11
    Else continue
15. Read the final block of data, append the data, and close the file on the PC
16. Write R49,801 = 3 to close the file
17. Write R49,809 = 1 to initiate the request
18. Read R49,807 and ensure the return code is 0

The data log is now on the PC and the file is closed on the SITRANS LUC500.

Interpret the data log based on the information in *Data Log File Structure* on page 156.

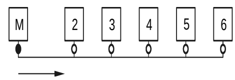
# Communication Appendix D: Unsolicited Slave

If you require the SITRANS LUC500 to respond in slave mode to requests from a SCADA system and send report by exception alerts in master mode, you must set the Unsolicited Slave setting in P770.

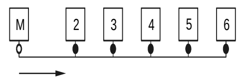
## Normal Modbus Operation

On a Modbus network there are master devices and slave devices that work on either a direct connection (RS-232) or a bus topology (RS-485). When using a bus topology, all slave nodes receive every message but ignore any message addressed to a different network ID.

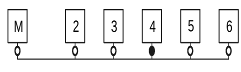
The master device initiates communication to network ID 4



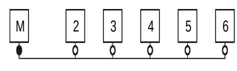

All nodes read message




Node with network ID 4 responds to Modbus commands




Repeat

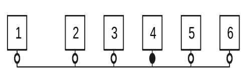



## Unsolicited Slave Operation

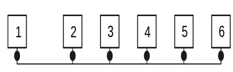
A slave node can operate as a master on the network as long as there is no other communication in progress at the time. For example, node 4 can act as a master device to node 1 which acts as a slave device.

The master node now operates as a slave during quiet times and so requires a network ID. In the example it is network ID #1.

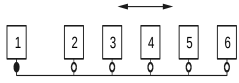
Node 4 changes from slave (passive) mode to master (active) mode and initiates communications with node 1



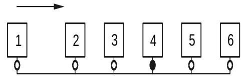

All nodes get the message




Node 1 is now acting as a slave and responds to Modbus commands




Repeat



# Timings

To avoid collisions on the bus, the SITRANS LUC500 that is configured for both slave and master operations waits for a quiet time before initiating communications.

Use the following parameters to configure an SITRANS LUC500 for both slave and master operation:

| Parameter | Index | Value | Description |
|---|---|---|---|
| P770 | 3 | 6 | Sets the SITRANS LUC500 to normally act as a Slave on the optional RS-485 communications port but to act as a Master when a report by exception is issued. |
| P486 | 3 | 2 | Watches the Rx Activity to determine when there is a quiet time. |
| P487 | 3 | 1000 | Wait for 1 second before starting the holding timer |
| P488 | 3 | 100 | Wait for 100ms x network address (P770) before issuing the report by exception |
| P473 | G | 6 | Send reports to device on network address 6 |
| P475 | G | 40 | Try to send the report 40 times before giving up |
| P476 | G | 3000 | Wait for 3 seconds for a response on each attempt |

The actual amount of time that an SITRANS LUC500 will wait is dependant on:

- P487 – Minimum Quiet Time
- P488 – Holding Time Constant
- P771 – Network Address
- Retry count for this communication attempt

Time = (P487) + (P488 x retry count x P771)

So, if the SITRANS LUC500 is set to P771 - Network Address = 4 and uses the defaults for P487 and P488 you would get the following timings:

Time 1 = 1000 + (100 x 0 x 4) = 1000ms = 1s

Time 2 = 1000 + (100 x 1 x 4) = 1400ms = 1.4s

Time 3 = 1000 + (100 x 2 x 4) = 1800ms = 1.8s

These timings ensure that multiple EnviroRangers will not attempt communication at the same time, as they must have different network addresses.

# Parameter Reference

The SITRANS LUC500 is configured through its parameters, and the application determines the parameter values that are entered into the unit.

# Helpful Hints

Please note the following:

- Default values are always indicated with an asterix (*)
- Global values are common for all inputs and outputs on the unit
- Indexed parameters can apply to more than one input or output
- Primary index relates to an input or output
- Secondary index allows for multiple values on an indexed point

### Accessing a Secondary Index

1. Press MODE and then press DISPLAY to activate secondary index. The → icon appears under the index field.
2. Enter the secondary index, and then enter the values to set the secondary index.

## P000 Lock

*Use this parameter to secure the SITRANS LUC500 from changes.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Value | 1954 | * | off (programming permitted) |
| | -1 | | simulation controls (relays energize based on simulated level) |
| | other | | lock activated (programming secured) |
| Related | • P132 Pump Start Delay<br>• *Simulation* on page 117. | | |

**WARNING: Use this lock as backup security only. It uses a fixed value which can be discovered by unauthorized personnel.**

Access this parameter directly (type the number **000**) and enter any value (other than 1954) to secure the programming lock. To unlock the SITRANS LUC500, access this parameter and enter the value **1954**.

# Quick Start (P001 to P009)

## P001 Operation

*Sets the type of measurement required for the application.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | level |

| | | | |
|---|---|---|---|
| Values | 0 | | Out-of-service |
| | 1 | | Level – how full the vessel is (a.k.a. volume – P050) |
| | 2 | | Space – how empty the vessel is (a.k.a. ullage – P050) |
| | 3 | * | Distance – distance from transducer to material |
| | 4 | | DPD – dual point difference of level |
| | 5 | | DPA – dual point average of level |
| | 6 | | OCM – flow rate in an open channel |
| | 7 | | Pump Totalizer – total pumped volume |
| | 10 | | DPS - dual point sum of level (Dual point model only.) |
| Alters | • P600 Primary Measuring Device | | |

## For DPD, DPA, and DPS Programming

### Single Point Model Use

For DPD (dual point difference), DPA (dual point average), or DPS (dual point sum) operation, the unit requires either two transducers of the same type, or one transducer and one mA input. If two transducers are used, all transducer parameters become indexed, and a third level point is calculated.

- DPD (difference) = Point 1 - Point 2 = Point 3
- DPA (average) = (Point 1 + Point 2) / 2 = Point 3

For these operations any of three level points (transducer 1, transducer 2, or the calculated point) can be used to trigger relays (see P110 Level Source).

### Dual Point Model Use

A dual point SITRANS LUC500 can control three independent applications – one on each transducer plus the calculated level. To set a dual point SITRANS LUC500 for DPA, DPD, or DPS functions, Point 3 must be set to either 4, 5, or 10 (as required). Points 1 and 2 cannot be set to 4, 5 or 10, but are used to calculate the average, difference or sum in level in Point 3.

This table shows the available functions for each index.

| Operation (index) | Available Values |
|---|---|
| P001 [1] | 1, 2, 3, 6, 7 |
| P001 [2] | 1, 2, 3, 6, 7 |
| P001 [3] | 4, 5, 10 |

So, when programming a unit with the Dual Point option you can specify any of the three level points (transducer 1, transducer 2, or the calculated level point) for any parameter indexed by level.

# P002 Material

*The type of material being measured, normally liquid.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 1 | * | Liquid or horizontal solid surface |
| | 2 | | Solid or angled surface |
| Alters | • P830 TVT Type | | |

# P003 Maximum Process Speed

*Determines how quickly the SITRANS LUC500 reacts to level changes.*

| | | | |
|---|---|---|---|
| Primary Index | transducer | | |
| Values: | 1 | | Slow (0.1 m/min) |
| | 2 | * | Medium (1 m/min) |
| | 3 | | Fast (10 m/min) |
| Alters | • P070 Failsafe Timer<br>• P700 Max Fill Rate<br>• P701 Max Empty Rate<br>• P702 Filling Indicator<br>• P703 Emptying Indicator<br>• P704 Rate Filter<br>• P710 Fuzz Filter<br>• P713 Echo Lock Window<br>• P727 Scan Delay<br>• P841 Long Shot Number | | |
| Related | • Failsafe (P070 to P072)<br>• P121 Pump by Rate<br>• Measurement Verification (P710 to P713)<br>• Transducer Scanning (P726 to P728)<br>• Rate (P700 to P708)<br>• P905 Transmit Pulse | | |

Use the setting which is just fast enough to keep up with your process. Slower settings provide higher accuracy while faster settings allow for more level fluctuations.

# P004 Transducer

*Specifies the Siemens Milltronics transducer connected to the unit.*

| | | | |
|---|---|---|---|
| Primary Index | **Single Point Model** | | **Dual Point Model** |
| | global | | transducer |
| Values | 0 | * | No transducer attached (preset for Dual Point Model) |
| | 1 | | ST-25 |
| | 2 | | ST-50 |
| | 100 | | STH |
| | 101 | | XCT-8 |
| | 102 | * | XPS-10 (preset for Single Point Model) |
| | 103 | | XCT-12 |
| | 104 | | XPS-15 |
| | 112 | | XRS-5 |
| | 250 | | Auxiliary mA input #1 |
| | 251 | | Auxiliary mA input #2 (see note below) |
| Related | • mA Input (P250 to P254)<br>• P842 Short Shot Frequency<br>• P843 Long Shot Frequency<br>• P844 Short Shot Width<br>• P845 Long Shot Width<br>• P852 Short Shot Range | | |

Enter the type of transducer(s) connected to the SITRANS LUC500. If multiple transducers are used they must be of the same type.

**Note:** Auxiliary mA input #2 is only available if cards 2I/2O or card 4AI are used.

# P005 Units

*Specifies the units used for dimensional values.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values: | 1 | * | Meters |
| | 2 | | Centimeters |
| | 3 | | Millimeters |
| | 4 | | Feet |
| | 5 | | Inches |
| Alters | • P006 Empty<br>• P007 Span<br>• P060 Decimal Position<br>• P603 Maximum Head<br>• P605 Zero Head<br>• P620 Low Flow Cutoff<br>• P921 Material Measurement<br>• P926 Head Measurement<br>• P927 Distance Measurement | | |

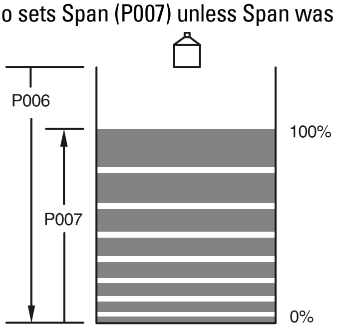
Changing this value automatically changes the units displayed for many parameters. Existing values are converted and do not have to be re-entered.

# P006 Empty

*The distance in units (P005) from the face of the transducer to the process empty point.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.000 to 9999 |
| | Preset: 5.000m (or equivalent depending on units) |
| Alters | • P007 Span |
| Altered By | • P005 Units |
| Related | • P800 Near Blanking<br>• P921 Material Measurement<br>• P927 Distance Measurement |

Setting this value also sets Span (P007) unless Span was already set to another value.




# P007 Span

*Span is the range of levels that the equipment is set to measure.*

| | |
|---|---|
| Primary Index | level |
| Values | Range: 0.0 to 9999 |
| | Preset: based on Empty (P006) |

| | |
|---|---|
| Alters | • P605 Zero Head<br>• P112 Relay ON Setpoint<br>• P113 Relay OFF Setpoint |
| Altered By | • P005 Units<br>• P006 Empty |
| Related | • Volume (P050 to P055)<br>• P800 Near Blanking<br>• P921 Material Measurement<br>• P922 Space Measurement<br>• P926 Head Measurement |

Span is preset for a value close to the maximum available. Enter a value that reflects the maximum range of your application.

Always prevent the monitored surface from approaching within 0.33 m (1 ft) of the transducer face as this is the minimum blanking for most Siemens Milltronics transducers. (Some require more blanking – see your transducer manual.)

Many other parameters are set as a percentage of span (even if they are entered in units). The values of these other parameters may change if the span is altered after installation and they are measured based on level (upwards from Empty towards the transducer face).

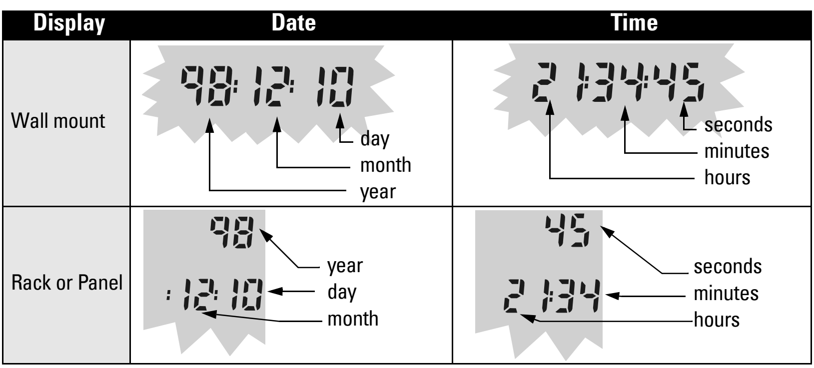
All volumes are based on span so it should be set for the maximum volume point if volume calculations are needed.

# P008 Date

*Date is the current date in the format: YY:MM:DD.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 70:01:01 to 69:12:31 |
| Related | • P009 Time |

The date is entered using the numeric keypad and the decimal key. For example, to enter December 10, 1998 type in the value **98.12.10**.




## Year 2000 Compliance

| | |
|---|---|
| 00-69 | Assumed to be the years 2000 to 2069 |
| 70-99 | Assumed to be the years 1970 to 1999 |

Parameters

## P009 Time

*Time is the current time in 24-hour format: HH:MM:SS.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 00:00:00 to 23:59:59 |
| Related | • P008 Date |

The time is entered using the numeric keypad and the decimal key. For example, to enter 9:34:45 p.m. you would type in the value **21.34.45**.

# Volume (P050 to P055)

To enable the SITRANS LUC500 to show readings based on vessel or wet well volume (rather than level) use these parameters.

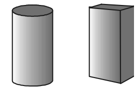
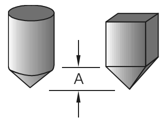
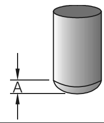
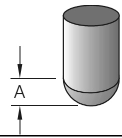
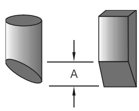
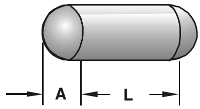
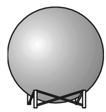
## P050 Tank Shape

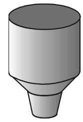
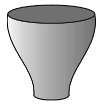
*Enter the Tank Shape value that matches the monitored vessel or wet well.*

When Operation is **level** (P001 = 1), liquid (material) volume is calculated. Alternatively, when Operation is **space** (P001 = 2), remaining vessel capacity is calculated.

In the RUN mode, Readings are displayed in percent of maximum volume. To convert Readings to volumetric units, see Max Volume (P051).

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |

| | # | Shape | Description |
|---|---|---|---|
| Values | 0 | * | volume calculation not required (preset) |
| | 1 |  | flat level bottom |
| | 2 |  | cone / pyramid bottom |
| | 3 |  | parabola bottom |
| | 4 |  | half sphere bottom |
| | 5 |  | flat sloped bottom |
| | 6 |  | flat ends |
| | |  | parabola ends |
| | 8 |  | sphere |

| | # | Shape | Description |
|---|---|---|---|
| Values (cont'd) | 9 |  | universal linear |
| | 10 |  | universal curved |
| Related | • P051 Maximum Volume<br>• Pump Efficiency (P180 to P186)<br>• P001 Operation<br>• Pumped Volume Totalizer (P622 to P623)<br>• P920 Reading Measurement | | |

# P051 Maximum Volume

*For Readings in volumetric units (rather than percent), enter the vessel volume between Empty (P006) and Span (P007).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.0 to 9999 | |
| | Preset: 100.0 | |
| Alters | • P060 Decimal Position | |
| Related | • P006 Empty<br>• P007 Span<br>• P924 Volume Measurement | |

Any volume units can be used as volume is calculated from empty to maximum span, and is scaled according to the Tank Shape (P050) value.

**Note:** Ensure that the chosen units will allow the volume to be displayed on the LCD. Examples:

1. If max. volume = 3650 $m^3$, enter **3650**.
2. If max. volume = 267500 gallons, enter **267.5** (1000's of gallons).

# P052 Tank Dimension A

*This is dimension **A** as used in P050 Tank Shape* on page 176.

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 0.000 | |
| Related | • P050 Tank Shape | |

Enter the height of the tank bottom if P050 = 2,3,4, or 5, or the length of one end section of the tank if P050 = 7, in Units (P005).

# P053 Tank Dimension L

*This is dimension L as used in P050 Tank Shape* on page 176.

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 0.000 | |
| Related | • P050 Tank Shape | |

Enter the tank length (excluding both end sections) if P050 = 7.

# P054 Breakpoint Levels (Universal Volume Calculation)

*When the tank shape is too complex for any of the preconfigured shapes you can specify the volume based on segments.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Secondary Index | breakpoint | |
| Values | Range: 0.000 to 9999 | |
| Related | • P055 Volume Breakpoints (Universal Volume Calculation) | |

Enter up to 32 level breakpoints (where volume is known) if P050 = 9 or 10.

### To enter a Level Breakpoint...

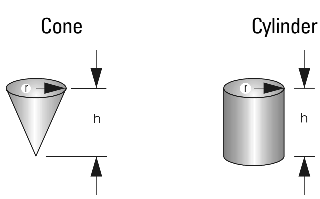
1. Go to Parameter P054
2. For each index enter a breakpoint in measurement units
3. Ensure that each breakpoint corresponds to the same index for P055

# P055 Volume Breakpoints (Universal Volume Calculation)

*Each segment defined by the level breakpoints (P055) requires a volume to allow the SITRANS LUC500 to make the level-to-volume calculations.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Secondary Index | breakpoint | |
| Values | Range: 0.0 to 9999 | |
| | Preset: 0.000 | |
| Related | • P054 Breakpoint Levels (Universal Volume Calculation) | |

### Some typical volume calculations are:




$V = (1/3)\pi r^2 h$ $V = \pi r^2 h$

### To enter a Volume Breakpoint...

1. Go to Parameter P055
2. For each index enter a volume
3. Ensure that each volume corresponds to the same index for P054

# Display and Reading (P060 to P062)

**Alter the following parameters to:**

- Change the number of decimal places displayed
- Convert the Reading to alternate units
- Reference measurements to other than Empty (P006) or Span (P007)

## P060 Decimal Position

*Defines the maximum number of decimal places used on the LCD.*

| | | | |
|---|---|---|---|
| Primary Index | level | | |
| Values | 0 | | no digits after the decimal point |
| | 1 | | 1 digit after the decimal point |
| | 2 | * | 2 digits after the decimal point |
| | 3 | | 3 digits after the decimal point (limited by device resolution) |
| Altered By | • P005 Units<br>• P051 Maximum Volume | | |
| Related | • P920 Reading Measurement | | |

In the RUN mode, the decimal position is adjusted to prevent the number of digits from exceeding the display capabilities. To keep the decimal place from shifting, reduce the number of decimal places to that shown at 100%.

e.g. If 100% is 15 m, use two decimal places for readings of 15.00 or 12.15.

## P061 Convert Reading

*Multiplies the current value by the specified amount to allow for scaling.*

| | |
|---|---|
| Primary Index | level |
| Values | Range: -999 to 9999 |
| | Preset: 1.000 |
| Related | • P920 Reading Measurement |

**Examples:**

- If the measured value is in feet, enter 0.3 to display the number of yards
- For simple linear volume conversions enter the volume measurement per unit to get the correct conversion. For example, if the reservoir contains 100 litres per vertical meter, use 100 to get the reading in litres.

**Notes:**
- This method does not calculate volume. It must not be used in place of the volume parameters if any volume dependent features (such as pump efficiency) are used. To calculate true volumes see Volume (P050 to P055) on page 176.
- Avoid entering a value that, when multiplied by the maximum current Reading, could exceed the display capabilities. If a value exceeds five digits then EEEE is displayed.

## P062 Offset Reading

*Adds the specified value to the reading, usually to reference the reading to sea level or another datum level.*

| | | |
|---|---|---|
| Primary Index | level | |
| Values | Range: -999 to 9999 | |
| | Preset: 0.000 | |
| Related | • P920 Reading Measurement | |

The operation of the device is not affected by the Offset Reading. This value is used for display purposes only. All control measurements are still referenced to Empty. Displayed Reading = Reading x P061 + P062, whether original reading is volume, flow or level (P001 dependent).

# Failsafe (P070 to P072)

## P070 Failsafe Timer

*The time for invalid measurements to elapse before Failsafe State activates.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 10.00 minutes | |
| Alters | P071 Failsafe Material Level | |
| Altered By | • P003 Maximum Process Speed | |
| Related | • P129 Relay Failsafe | |

**Once activated, the Failsafe State initiates the following:**

1. The material level is reported based on P071 Failsafe Material Level.
   a. The unit responds to the new level as programmed (control and alarm relays activate as defined by the programming)
   b. Individual relays can have independent failsafe responses. See P129 Relay Failsafe.
2. The appropriate error is displayed:
   a. LOE for loss of echo from the transducer
   b. Short for a shorted transducer cable
   c. Open for a cut transducer cable
   d. Error for all other problems

When modifying the preset value, use one that is short enough to protect the process but long enough to avoid false alarms. Only use No Delay for testing.

# P071 Failsafe Material Level

*The material level reported when a Failsafe State is initiated.*

| | | | |
|---|---|---|---|
| Primary Index | level | | |
| Values | 0.000 to 9999 | | Value in units or % (to 150% of span) |
| | HI | | Level goes to maximum span |
| | LO | | Level goes to 0 span (Empty) |
| | HOLd | * | Level remains at last reading |
| Related | • P001 Operation<br>• P006 Empty<br>• P007 Span<br>• P111 Relay Control Function<br>• P112 Relay ON Setpoint<br>• P113 Relay OFF Setpoint<br>• P129 Relay Failsafe | | |

Select the Failsafe Material Level based upon the relay operation required during failsafe operation.

### Selecting HI, LO, or HOLd

1. Press to display the Auxiliary Function symbol,
2. Press or as required to scroll to the desired option,
3. Press to enter the value.

### Entering a Measurement

To enter a specific Failsafe Material Level within -50 to 150 % of Span (P007), in Units (P005) or % of Span.

### Relay reaction

The way in which relay programming reacts to the failsafe level depends on P129 Relay Failsafe (page 189). By default:

- Alarm relays have P129 = **OFF** and so react to the Failsafe Material Level.
- Control relays have P129 = **dE** and so de-energize the relay when the unit enters Failsafe mode regardless of the Failsafe Material Level.

# P072 Failsafe Level Advance

*The speed the ERS advances to and returns from the Failsafe Material Level.*

| | | | | |
|---|---|---|---|---|
| Primary Index | level | | | |
| Values | 1 | * | Restricted | advances to/from Failsafe Material Level as set by P003, P700 and P701. |
| | 2 | | Immediate | Failsafe Material Level assumed right away |
| | 3 | | Fast Back | Failsafe Level Advance is restricted, returns to a new measured material level. |
| Related | • P003 Maximum Process Speed<br>• P700 Max Fill Rate<br>• P701 Max Empty Rate<br>• P070 Failsafe Timer<br>• P071 Failsafe Material Level | | | |

# Relays (P100 to P119)

The SITRANS LUC500 has five relays (or digital outputs) to control devices and alarms. While the number of devices is limited by the relays, all control functions are accessible through software and each parameter is indexed to the five relays.

**Preset Applications (P100):** The SITRANS LUC500 makes standard applications easier to program by providing an extensive list of presets.

**Control Functions (P111):** Each relay can be configured independently to take advantage of the SITRANS LUC500's advanced features and flexibility. Start with a preset application and change the required parameters to make the task more efficient.

**Setpoints (P112, P113, P114, P115):** Each relay is triggered by one or more setpoints. The setpoints can be based on absolute level (P112, P113), rate of change (P702, P703), or time (P114, P115). Each control function specifies which setpoints are required.

## P100 Preset Applications

*There are six preset applications to configure or bench test the unit.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 1 to 6 | | |
| | 0 | * | off |
| | 1 | | wet well 1 |
| | 2 | | wet well 2 |
| | 3 | | reservoir 1 |
| | 4 | | reservoir 2 |
| | 5 | | screen |
| | 6 | | alarms |
| Alters | • P110 Level Source<br>• P111 Relay Control Function<br>• P112 Relay ON Setpoint<br>• P113 Relay OFF Setpoint<br>• P121 Pump by Rate | | |
| Related | • P001 Operation | | |

Select an application that is similar to yours and change the parameters required. If none suit, then refer to *P111 Relay Control Function* on page 184.

**Note:** Programming the relays independently is the most common method used.

For screen applications (P100=5) the SITRANS LUC500's operation must be set to difference (P001=4).

## P110 Level Source

*The level source on which the indexed relay matches setpoints.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Range: 1 to 3 (1 to 32 when P111=66) | | |
| | 1 | * | Point 1 = transducer 1 |
| | 2 | | Point 2 = transducer 2 |
| | 3 | | Point 3 =difference(P001=4) or average(P001=5) or sum (P001=10) |
| | 1 to 32 | | Trigger number to track (when P111=66) |
| Altered By | • P001 Operation<br>• P100 Preset Applications | | |

**Note:** P110 will only have a range of 1 to 32 if P111=66. Set P111 to 66 and then set P110.

**In Single Point Mode (standard):** Pts. 2 and 3 are available when operation is set for difference, average, or sum (P001 = 4, 5, or 10).

**In Dual Point Model (optional):** Point 2 is always available, and Point 3 is available only if Operation is set for difference, average, or sum (P001 = 4, 5, or 10).

# P111 Relay Control Function

*The control algorithm used to trip the relay.*

| | |
|---|---|
| Primary Index | relay |
| Values | See the Values for P111 table on page 185 |
| Altered By | • P100 Preset Applications |

Use zero **0** (preset) to disable control of the indexed relay.

# P112 Relay ON Setpoint

*The process point at which the relay changes from its **normal** state.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: -999 to 9999 |
| | Preset: ---- |
| Altered By | • P007 Span |
| Related | • P100 Preset Applications<br>• P111 Relay Control Function<br>• P113 Relay OFF Setpoint |

For most applications this is the point at which the relay is tripped. For **in-bounds** and **out-of-bounds** alarms it is the high point in the specified range. This parameter is set according to Span (P007) even when another reading, such as volume, is shown on the LCD.

# P113 Relay OFF Setpoint

*The process point at which the relay returns to its **normal** state.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: -999 to 9999 |
| | Preset: ---- |
| Altered By | • P007 Span |
| Related | • P100 Preset Applications<br>• P111 Relay Control Function<br>• P112 Relay ON Setpoint |

For most applications this is the point at which the relay is reset. For **in-bounds** and **out-of-bounds** alarms it is the low point in the specified range. This parameter is set according to Span (P007) even when another reading, such as volume, is shown on the LCD.

### Values for P111

| Control | Type | #[1] | Relay Control |
|---|---|---|---|
| General | Off | 0 * | Relay set off, no action (preset) |
| Alarm | Level | 1 | based on level setpoints ON and OFF |
| | In Bounds | 2 | when level enters the range between ON and OFF setpoints |
| | Out of Bounds | 3 | when level exits the range between ON and OFF setpoints |
| | Rate of Change | 4 | based on rate setpoints ON and OFF |
| | Temperature | 5 | based on temperature setpoints ON and OFF |
| | Loss of Echo (LOE) | 6 | when echo is lost |
| | Cable Fault | 7 | when the circuit to a transducer is opened |
| | Pump Efficiency | 8 | based on pump volume calculations (P512) |
| | Time of Day | 9 | based on the clock |
| | Clock Failure | 10 | if the clock module fails |
| | Pump Failure | 11 | based on P510 |
| | Power Failure | 12 | based on P519 |
| Flow | Totalizer | 40 | every $10^y$ units (P640-P645) |
| | Flow Sampler | 41 | every n x $10^y$ units (P641-P645) or time duration (P115) |
| Pump | Fixed Duty Assist | 50 | at fixed ON and OFF setpoints and allows multiple pumps to run |
| | Fixed Duty Backup | 51 | at fixed ON and OFF setpoints and allows only one pump to run |
| | Alternate Duty Assist | 52 | at rotating ON and OFF setpoints and allows multiple pumps to run |
| | Alternate Duty Backup | 53 | at rotating ON and OFF setpoints and allows only one pump to run |
| | Service Ratio Duty Assist | 54 | on service ratio at ON and OFF setpoints and allows multiple pumps to run |
| | Service Ratio Duty Backup | 55 | on service ratio at ON and OFF setpoints and allows only one pump to run |
| | First In First Out (FIFO) | 56 | as Alternate Duty Assist, resets the relay from staggered OFF setpoints. |
| Control | Time | 60 | based on DURATION and INTERVAL setpoints |
| | Overflow | 61 | based on overflow/underflow event. |
| | Aeration | 62 | based on DURATION and INTERVAL setpoints timed from when pump relays shut off |
| | Gate | 63 | used to drive a gate based on ON, INTERVAL, and DURATION setpoints |
| | Flush Valve | 64 | used to control a pump flushing device based on Flush Systems (P170 to P173) |
| | Communication | 65 | based on input from external communications. See *Communications* for more information. |
| | Trigger[2] | 66 | relay specified will follow state of P424, trigger state.[2] |
| | Watchdog Relay / Heartbeat Output | 67 | relay will toggle on and off at a rate set by P114 and P115 |

1. When reading and setting this parameter through Modbus or SmartLinx communications the parameter values are mapped to different numbers. See the SITRANS LUC500 *Communications* section for Modbus information or the relevant SmartLinx® instruction manual.
2. After setting P111=66, set P110 to identify the trigger number to track.

# P114 Relay DURATION Setpoint

*The length of time in minutes* the relay is to be energized.*

| | | |
|---|---|---|
| Primary Index | relay | |
| Values | Range: 0.000 to 9999 | |
| | Preset: ---- | |
| Altered By | • P100 Preset Applications | |
| Related | • P111 Relay Control Function (P111=9,60,62,63,67)<br>• P115 Relay INTERVAL Setpoint<br>• P134 Pump Exercising (P111=50 to 56) | |

This value must be less than the **interval** setpoint or the relay will never reset.

***Note:** When P111 = 67 (Watchdog Relay), the length of time is measured in milliseconds**.** When P111=9 (Timed Relay), this value should be less than 1440 (number of minutes in a day).

# P115 Relay INTERVAL Setpoint

*The length of time in hours* between timed starts.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 0.000 |
| Altered By | • P100 Preset Applications |
| Related | • P111 Relay Control Function (P111=9,60,62,63)<br>• P114 Relay DURATION Setpoint<br>• P134 Pump Exercising (P111=50 to 56) |

This value must be greater than the **duration** setpoint or the relay will never reset.

***Note:** When P111 = 67 (Watchdog Relay), the length of time is measured in seconds.

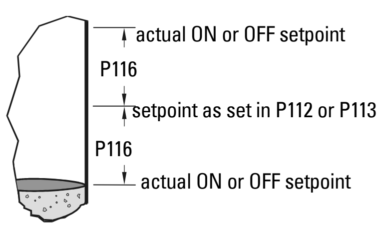
# P116 Dead Band

*The distance above and below the bound alarm setpoints.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 2% of span |
| Related | • P111 Relay Control Function<br>• P112 Relay ON Setpoint<br>• P113 Relay OFF Setpoint |

For **in-bounds** and **out-of-bounds** Relay Functions (P111 = 2 and 3 respectively) a dead band prevents relay chatter due to material level fluctuations at both the upper and lower setpoints.

Enter the dead band in either percent of span or units of measure (P005). The dead band value is applied both above and below the upper and lower bound setpoints as shown in the figure.



# P118 Relay Output Logic

*The logic applied to relays to determine the contact open or closed state.*

| Primary Index | relay | | | | |
|---|---|---|---|---|---|
| Values | **Value** | | **Logic** | **Alarm contact** | **Pump or control contact** |
| | 2 | * | positive | Normally Closed | Normally Open |
| | 3 | | negative | Normally Open | Normally Closed |
| Related | • P111 Relay Control Function | | | | |

The relay contact operation is **normally closed** for alarms and **normally open** for controls. See *P111 Relay Control Function* on page 184 for more information.

### Power Failure

When power is cut to the SITRANS LUC500, its relays fail in the following states:

| Rack or Panel Mount | |
|---|---|
| **Relay** | **Fail State** |
| 1-4 | Open |
| 5 | Closed |

| Wall Mount | |
|---|---|
| **Relay** | **Fail State** |
| 1-4 | Open |
| 5 | Open or Closed[1] |

1. Relay 5 is a Form C type on the Wall mount SITRANS LUC500 so you can wire it either normally open or normally closed. Check the wiring before programming.

To use relay 5 as a general alarm indicator, set P118 to **3 – negative logic** and wire the alarm for normally open operation. When an alarm event occurs (see below) or when power is cut the circuit closes and the alarm sounds.

### Positive Logic

In software all relays are programmed the same way, with ON setpoints indicating when to change the relay contact state (open or closed). This parameter allows the reversal of the operation so that relay contacts can be **normally closed** or **normally open**. P118 is preset to **2** which is positive logic.

### Negative Logic

When P118 = 3 (negative logic) the operation for the indexed relay is reversed from normal.

# P119 Relay Logic Test

*Used to force the relay control logic into an **activated** or **de-activated** state.*

| Primary Index | relay | | |
|---|---|---|---|
| Values | 0 | * | off – control from SITRANS LUC500 algorithms |
| | 1 | | activate relay control |
| | 2 | | de-activate relay control |
| Related | • P111 Relay Control Function | | |

Use this parameter to test your site wiring and control logic programming. Forcing the relay to an activated or de-activated state is similar to the SITRANS LUC500 detecting an event and responding to it. This is helpful in testing new installations and diagnosing control problems.

# Pump Setpoint Modifiers (P121 and P122)

These parameters provide alternate ways of starting the pumps in the pump group. See *Pump Control* section beginning on page 84 for descriptions of the pump control algorithms.

## P121 Pump by Rate

*Used to set the pump relays to accept control by rate of level change once the first ON setpoint is reached.*

| | | | | |
|---|---|---|---|---|
| Primary Index | **Single Point Model** | | | **Dual Point Model** |
| | transducer | | | level |
| Values | 0 | * | off (pump by level) | |
| | 1 | | on (pump by rate) | |
| Related | • P007 Span<br>• P111 Relay Control Function<br>• P132 Pump Start Delay<br>• Rate (P700 to P708) | | | |

Use this function when there are multiple pumps which should be controlled by rate of level change rather than setpoints. Rate of change is set by P702 and P703.

The delay between pump starts is set by *P132 Pump Start Delay* on page 190.

This only applies to any relays set to pump control (P111 = 50 to 56).

**Notes:**
- All pump control relay ON and OFF setpoints must be the same value.
- If the level is within 5% of Span (P007) of the OFF setpoint then the next pump is not started.

## P122 Pump Service Ratio

*Selects pump usage based on the run time ratio rather than last used.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 20.00 |
| Related | • P111 Relay Control Function |

This parameter only relates to relays with P111=54 or 55.

To make this parameter useful, assign it to all of the pump relays. The number assigned to each pump relay represents the ratio that is applied when determining the next pump to start or stop.

**Notes:**
- The SITRANS LUC500 will not sacrifice other pumping strategies to ensure that the ratio is held true.
- If the pump relays are set to the same value then the ratio equals 1:1 and all pumps are used equally (preset).

# Independent Relay Failsafe (P129)

## P129 Relay Failsafe

*Sets the failsafe operation per relay to allow for more flexible programming.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | OFF | * | response governed by P071 Failsafe Material Level |
| | HOLd | | for last known relay state retention |
| | dE | * | to have the relay de-energize immediately on failsafe |
| | En | | to have the relay energize immediately on failsafe |
| Altered By | • P071 Failsafe Material Level | | |
| Related | • P070 Failsafe Timer<br>• P111 Relay Control Function | | |

Use this for operations independent of the Failsafe Material Level (P070).

Relay Failsafe is only available for the following relay functions (P111) and not used for any other relay control function.

| Relay Function (P111) | Preset (P129) |
|---|---|
| 1 – level alarm | OFF |
| 2 – in bounds alarm | |
| 3 – out of bounds alarm | |
| 4 – rate of change alarm | |
| 5 – temperature alarm | |
| 9 – time of day alarm | |
| 50 to 56 – all pump controls | dE |

**To select an independent Relay Failsafe value:**

1. Press ▲% to display to the Auxiliary Function symbol,
2. Press ▲ or ▼ to scroll to the failsafe options.
3. Press ↵ with the desired option displayed.

# Advanced Pump Control Modifiers (P130 to P136)

These parameters affect only relays set to pump operation (P111 = 50 to 56).

## P130 Pump Run-On Interval

*The number of hours between pump run-on occurrences.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 1000 |
| | Preset: 0.000 (pump run-on disabled) |
| Related | • Advanced Pump Control Modifiers (P130 to P136) |

To clear sediment in a pump-down wet well, run the pump after the normal OFF setpoint is reached to force some solid material through. This parameter sets the time between such events. Only the last pump running can run-on.

**Note:** This feature cannot be used when the SITRANS LUC500 is set to average, differential, or sum (P001 = 4, 5, or 10).

# P131 Pump Run-On Duration

*The number of seconds that the pump runs-on.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 0.000 |
| Related | Advanced Pump Control Modifiers (P130 to P136) |

Each pump capacity will determine the amount of material that can be removed. Choose a value long enough to clean out the vessel bottom, yet short enough not to run the pump dry. Also be sure that this value does not overlap with P130 (Interval).

# P132 Pump Start Delay

*The minimum delay (in seconds) between pump starts.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 10 seconds |
| | Value is divided by 10 in simulation mode. |
| Related | • Advanced Pump Control Modifiers (P130 to P136)<br>• P121 Pump by Rate |

Use this feature to reduce a power surge from all pumps starting at the same time. This delay determines when the next pump is permitted to start.

# P133 Pump Power Resumption Delay

*The minimum delay before the first pump restart after power failure.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 9999 |
| | Preset: 10 seconds |
| Related | • Advanced Pump Control Modifiers (P130 to P136)<br>• P132 Pump Start Delay |

This reduces the surge from the first pump starting immediately on power resumption. When this delay expires, other pumps will start as per P132.

# P134 Pump Exercising

*Runs the pump periodically to reduce pump corrosion or sediment build up.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | off |
| | 1 | | on (use P114 and P115 for timing information) |
| Related | • P114 Relay Duration Setpoint<br>• P115 Relay Interval Setpoint | | |

If a pump remains idle for the time as defined by P115 (Interval) then the pump runs for the time specified by P114 (Duration).

## P135 Pump Exercise Mode

*Sets whether or not to use the off level setpoint when exercising the pumps.*

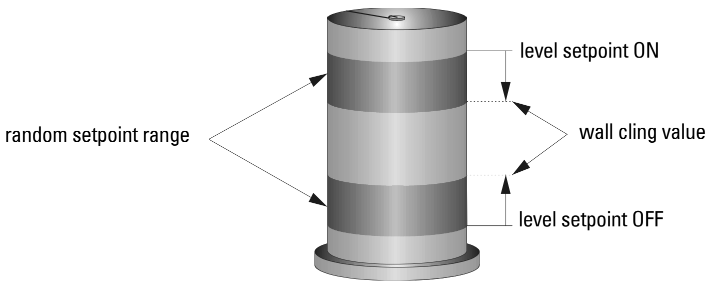
| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | level must be above the off setpoint for pumps to be exercised |
| | 1 | | CSO screen rake mode – off level setpoint is ignored when exercising the pumps. |
| Related | • P113 Relay OFF Setpoint<br>• P134 Pump Exercising | | |

## P136 Wall Cling Reduction

*Varies the upper and lower setpoints to reduce material buildup on the walls.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 0.000 | |

This value is the range in which the setpoints are allowed to deviate in percent or units. The Relay Setpoints ON and OFF values are randomly varied inside the range to ensure that the material level does not consistently stop at the same point.




## P137 Pump Group

*Puts pumps into groups for multiple pump rotations on one transducer.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Range: 1 to 2 | | |
| | 1 | * | group 1 |
| | 2 | | group 2 |
| Alters | • P111 Relay Control Function when P111=52 (Alternate duty assist) or 53 (Alternate duty backup) | | |

This feature groups pumps (relay points 1 - 5) into groups 1 or 2. It is applied to pump rotation and occurs independently within each group.

# Pump Energy Cost Reduction (P140 to P146)

Use these parameters to maximize your unit's operation during periods of low energy cost and minimize its operation during periods of high cost. They only affect relays set to pump operation (P111 = 50 to 56).

**The methods used to achieve this are:**

1. Emptying the wet well just prior to the high cost period, regardless of material level (P141, P142, and P143).
2. Changing setpoints for high cost and low cost periods (P144 and P145).

# P140 Energy Saving

*Shifts pump operation to low cost periods from more expensive ones.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | off |
| | 1 | | on (do not pump during peak energy cost, if possible) |
| | 2 | | on but allow override |
| Related | • Energy Cost Reduction Override (P148 to P149) | | |

# P141 Peak Start Times

*The time of day when high-energy costs (to be avoided) start.*

| | |
|---|---|
| Primary Index | break point |
| Values | Range: 00:00 to 23:59 |
| | Format: HH:MM |
| | Preset: 00:00 |
| Related | • P142 Peak End Time |

Used in conjunction with P142 (Peak End Time) to define the high cost period and indexed by the number required in a 24-hour span. (Up to 10).

# P142 Peak End Time

*The time of day when high energy costs (to be avoided) end.*

| | |
|---|---|
| Primary Index | break point |
| Values | Range: 00:00 to 23:59 |
| | Format: HH:MM |
| | Preset: 00:00 |
| Related | • P141 Peak Start Times |

Used in conjunction with P141 (Peak Start Time) to define the high cost period and indexed by the number required in a 24-hour span. (Up to 10). All end times must have the same index value as the corresponding start time.

# P143 Peak Lead Time

*The time in minutes before the Peak Start Time that the SITRANS LUC500 will begin pumping.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 1440 |
| Related | • P142 Peak End Time<br>• P141 Peak Start Times |

This value determines when pumping should start to ensure the level is as far as possible from the Relay Setpoint ON (P112) level. (If level is already within 5% of Span from Relay Setpoint OFF (P113) level, no action occurs). If multiple pump stations are series linked, ensure the Peak Lead Times entered are sufficient to attain the desired level in all stations before the high-energy cost period occurs.

# P144 Peak ON Setpoint

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 0.000 |
| Related | • P145 Peak OFF Setpoint |

To allow the level to go beyond the normal Relay Setpoint ON before a pump is started, enter the value to be used for the high-energy cost period.

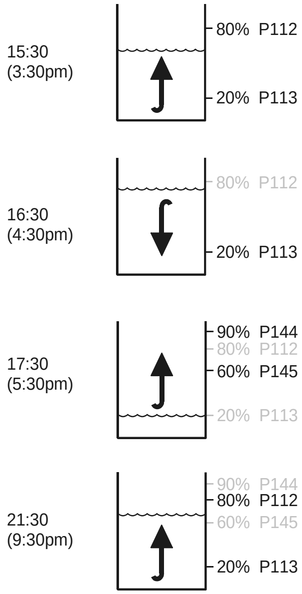
# P145 Peak OFF Setpoint

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| | Preset: 0.000 |
| Related | • P144 Peak ON Setpoint |

To stop the pump(s) before the normal Relay Setpoint OFF and reduce pump-running time. Enter the value to be used for the high cost period.

# Energy Savings Example

The following example illustrates high energy cost usage reduction and/or elimination by utilizing the SITRANS LUC500 Pump Energy Cost Reduction features on a wet well (pump down application).




**Normal Operation**
Uses the standard ON and OFF setpoints (P112 / P113). Energy cost is at minimum.

**Peak Lead time (P143 = 60 minutes)**
Pumps down the wet well regardless of the Relay ON Setpoints. This ensures that the wet well starts the high cost period at the pumps' OFF setpoint. Energy cost is at minimum.

**Peak Start Time (P141 = 17:30)**
Starts using the energy savings setpoints (P144 and P145). Energy cost is at maximum.

**Peak End Time (P142 = 21:30)**
Returns to normal setpoints (P112 and P113). Energy cost returns to minimum.

**Note:** When the Peak ON Setpoint is not reached, no energy is used during the high cost period. If the Peak ON Setpoint is reached, the Wet Well is only pumped down to 60%, thereby minimizing high cost energy usage.

## P146 Time of Day Setpoint

| | | |
|---|---|---|
| Primary Index | relay | |
| Values | Range: 00:00 to 23:59 | |
| | Format: HH:MM | |

Sets the time at which a relay set for time day alarm (P111=9) will trip.

# Energy Cost Reduction Override (P148 to P149)

Use these parameters to specify an override of the Pump Energy Cost Reduction Parameters (P140 to P145). They only affect relays set to pump operation (P111 = 50 to 56).

**There are two conditions that can trigger an override:**

1. specific instructions from a discrete input, and
2. an overflow/underflow condition as per *P169 Flow Condition* on page 197.

**Note:** P169 Flow Condition is set when an overflow or underflow condition is detected according to the user-defined settings in *P160 Overflow / Underflow Level Source* on page 195.

## P148 Manual Override

*Sets the discrete input that will trigger an override*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | off (no manual override) |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Related | • P140 Energy | | |

This input is in effect as long as it is asserted and does not unlatch after the high-energy period.

**Note:** The SITRANS LUC500 base unit has 8 discrete inputs. An optional board can expand this to 16. See *Installing Optional Cards* on page 15 for more details.

## P149 Energy Override Status

*Displays the status of the Energy Override feature.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | there is no override |
| | 1 | | override by P169 |
| | 2 | | override by P148 |
| | 3 | | override by P169 and P148 |
| Related | • P148 Manual Override<br>• P169 Flow Condition | | |

The Energy Cost Reduction parameters can be overridden if P169 is set to indicate either an overflow or an underflow condition, and/or P148 is set so that a discrete input will report an offending condition.

# Overflow / Underflow (P160 to P169)

## P160 Overflow / Underflow Level Source

*Defines the method and source used to detect a flow condition.*

<table>
<tr><td>Primary Index</td><td colspan="4">flow condition</td></tr>
<tr><td rowspan="14">Values</td><td colspan="4">Format: x:y, where x=type and y=point</td></tr>
<tr><td colspan="4">Preset: 0:0</td></tr>
<tr><td></td><td>Input</td><td>x</td><td>y</td></tr>
<tr><td rowspan="2">Overflow</td><td>Transducer level</td><td>1</td><td>1 – transducer 1<br>2 – transducer 2<br>3 – average, difference or sum (P001=4, 5, or 10)</td></tr>
<tr><td>Discrete Input</td><td>2</td><td>0 to 8 – with base unit<br>9 to 16 – with 8DI card</td></tr>
<tr><td rowspan="2">Underflow</td><td>Transducer level</td><td>3</td><td>1 – transducer 1<br>2 – transducer 2<br>3 – average, difference or sum (P001=4, 5, or 10)</td></tr>
<tr><td>Discrete Input</td><td>4</td><td>0 to 8 – with base unit<br>9 to 16 – with 8DI card</td></tr>
<tr><td>Overflow</td><td>Transducer rate of change</td><td>5</td><td>1 – transducer 1<br>2 – transducer 2<br>3 – average, difference or sum (P001=4, 5, or 10)</td></tr>
<tr><td>Underflow</td><td>Transducer rate of change</td><td>6</td><td>1 – transducer 1<br>2 – transducer 2<br>3 – average, difference or sum (P001=4, 5, or 10)</td></tr>
<tr><td>Related</td><td colspan="4">• Energy Cost Reduction Override</td></tr>
</table>

**Example:** To configure a float at discrete input #5 to trigger an overflow event, assign P160 a value of 2:5. Use 0:0 to disable overflow logging. If either value is set to 0 then no overflow or underflow action is enabled.

To enter a colon (:) , press the decimal  button on the keypad.

**Notes:**

- You must specify the correct overflow or underflow settings for your ON and OFF setpoints. If these values don't match (for example, Overflow set as 1:1 and ON setpoint below OFF setpoint) then no action is taken.
- The SITRANS LUC500 base unit has 8 discrete inputs. An optional board can expand this to 16. See *Installing Optional Cards* on page 15 for more details.

## P161 Overflow / Underflow Setpoint ON

*The point at which the flow event is triggered.*

<table>
<tr><td>Primary Index</td><td>flow condition</td></tr>
<tr><td rowspan="2">Values</td><td>Range: 0.000 to 9999</td></tr>
<tr><td>Preset: 0.000</td></tr>
<tr><td>Related</td><td>• P162 Overflow / Underflow Setpoint OFF</td></tr>
</table>

This setpoint is used only if the level source (P160) is a transducer or mA input. If a discrete input is being used then this parameter is ignored.

**Notes:**

- For overflow events the ON setpoint must be above the OFF setpoint or no events are logged.
- For underflow events the OFF setpoint must be above the ON setpoint or no events are logged.

When *Transducer Rate of Change* is selected as Level Source (P160, with value x being 5 or 6), ON and OFF setpoints (P161 and P162) are used to specify the rate setpoints. To specify the overflow setpoints, use positive numbers for P161 and P162, and for the underflow setpoints, use negative. This is similar to a P111 = 4 rate alarm with P112 and P113 rate setpoints.

# P162 Overflow / Underflow Setpoint OFF

*The point at which the flow event is reset.*

| | |
|---|---|
| Primary Index | flow condition |
| Values | Range: 0.000 to 9999 |
| | Preset: 0.000 |
| Related | • P161 Overflow / Underflow Setpoint ON |

This setpoint is used if the level source (P160) is a transducer or mA input. If a discrete input is being used then this parameter is ignored.

# P163 Overflow / Underflow Time Delay

*Defines the time, in seconds, used to calm (debounce) the flow condition inputs.*

| | |
|---|---|
| Primary Index | flow condition |
| Values | Range: 0.000 to 9999 |
| | Preset: 5.0 |
| Related | • P164 Overflow / Underflow Maximum Duration |

This debounce timer keeps the unit from logging momentary flow conditions and is used when the level source is no longer ON. The flow condition remains in effect for the time specified in case the level source detects a flow condition again. A value of zero **0** disables the timer, and it is ignored unless the level source (P160) is a discrete input (value x=2 or 4).

# P164 Overflow / Underflow Maximum Duration

*Defines the maximum time, in minutes, that a flow condition can remain in effect.*

| | |
|---|---|
| Primary Index | flow condition |
| Values | Range: 0.000 to 9999 |
| | Preset: 360.0 |
| Related | • P163 Overflow / Underflow Time Delay |

**A flow condition is reset by one of three events:**

- The measured level moves past the OFF setpoint (P162)
- The discrete input (if used) is reset and the time delay (P163) expires
- The time of the flow condition exceeds the Flow Max Duration (P164) value

When the flow condition is reset, any forced relays revert back to their normally-programmed state. Ensure that the time given here is appropriate for the application. **0** disables this feature.

# P165 Overflow / Underflow Relay Action

*Determines how relays operate during a flow condition.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Secondary Index | flow condition | | |
| Values | 0 | * | no action |
| | 1 | | forced on during overflow event |
| | 2 | | forced off during overflow event |
| Related | • P111 Relay Control Function | | |

Use this feature to activate on an overflow or underflow condition. It is useful for tracking CSO or for using floats to bypass the normal pump control. Only relays that have been configured with a Relay Control Function (P111) of **alarm** or **pump** can be used.

**Note:** Only one flow condition should be specified for P165. If more than one flow condition is attempting to drive a relay, the lowest number flow condition will prevail.

# P166 Overflow Discharge Volume Source

*Determines the transducer used to calculate discharge volume.*

| | | | |
|---|---|---|---|
| Primary Index | flow condition | | |
| Values | 0 | * | Disabled |
| | 1 | | Ultrasonic Transducer 1 |
| | 2 | | Ultrasonic Transducer 2 |
| Alters | • P316 Overflow Event Volume | | |
| Related | • P001 Operation<br>• P600 Primary Measuring Device | | |

To use a transducer to calculate discharge volume, it must be set as an OCM device. For more details, see Operation (P001) and OCM Measuring Device (P600).

If this parameter is disabled (as it is in its default setting), then Overflow Event Volume (P316), will display its default view (----).

# P169 Flow Condition

*Indicates if the unit is in an overflow or underflow condition.*

| | | | |
|---|---|---|---|
| Primary Index | flow condition | | |
| Values | Format: View only | | |
| | 0 | * | normal operation |
| | 1 | | in overflow condition |
| | 2 | | in underflow condition |
| Alters | • Overflow / Underflow Records (P313 to P317) | | |
| Related | • P149 Energy Override Status | | |

# Flush Systems (P170 to P173)

Use this feature to control an electrically operated flush valve on a pump to divert some pump output back into the wet well to stir up sediment.

**Notes:**

- The settings of these parameters affect the operation of all relays with P111 set to 64 – Flush Valve.
- If any of the following parameters are set to 0, this feature will not work.
- In Dual Point Model, a flush valve can be set up for each of the three available level inputs (P001 = 4, 5, or 10).

## P170 Flush Pump

*The number of the pump relay that triggers the flushing device.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | global | relay |
| Values | Range: 0 to 5 | |
| | Preset: 0 | |
| Related | • P111 = 64, Flush Valve | |

### Single Point Model

Enter the SITRANS LUC500 relay number of the pump with the flush valve. The activation of this pump relay drives the usage of the flush system. Both P172 Flush Interval and P171 Flush Cycles are based on the operation of this relay and control any relay set to P111 = 64, Flush Valve.

### Dual Point Model

The indexed relay is the one that controls the flush device. The value is the pump relay that is watched by the flush system. Enter the pump relay value into the parameter at the flush relay index.

### For Example

If you need to watch pump relay 1 to control a flush valve on relay 2 you would set P170[2]=1.

## P171 Flush Cycles

*The number of pump cycles for which flush control is required.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | global | relay |
| Values | Range: 0 to 9999 | |
| | Preset: 0 | |
| Related | • P111 = 64, Flush Valve | |

**If three flush cycles are required after every 10 pump cycles then:**

P172 (Flush Interval) = 10

P171 (Flush Cycles) = 3

## P172 Flush Interval

*The number of pump cycles which occur before flush control is enabled.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | relay |
| Values | Range: 0 to 9999 | |
| | Preset: 0 | |
| Related | P111 = 64, Flush Valve | |

To start a new flush cycle every ten times the pumps are run, set this to **10**.

## P173 Flush Duration

*The length of time for each flush cycle that the flush control is active.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | relay |
| Values | Range: 0.000 to 9999 | |
| | Preset: 0.000 | |
| Related | • P111 = 64, Flush Valve | |

# Pump Efficiency (P180 to P186)

The efficiency of the pumps is calculated on volume change in the wet well or reservoir. Any application using pump efficiency must have accurate values in the Volume (P050 to P055) parameters beginning on page 176.

Pump faults can also be indicated by input from pump interlocks. See Pump Interlock Allocation (P500 to P509) on page 233 for more information.

## P180 Pump Capacity Reference

*The setpoint of Pump Capacity (P183) which triggers a low efficiency alert.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 100.0 |
| Related | • P111 Relay Control Function<br>• Pump Control<br>• Volume (P050 to P055) |

This value is entered in percent of P183 Pump Rated Capacity, and is compared to the calculated value when the pump is started. If it does not change as quickly as it should then a pump low efficiency alert is triggered.

## P181 Pump Capacity Time

*The time, in seconds, that the actual pump capacity (P182) is calculated.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 9999 |
| | Preset: 180 (sec) |
| Related | • P182 Pump Measured Capacity |

If another pump is about to start or stop, or this pump is about to stop, the time is cut short and the calculation is done prematurely. The user can ensure that another pump does not start before the pump rate has achieved its operating value by increasing the pump start delay (P132).

# P182 Pump Measured Capacity

*The actual Pump Capacity value divided by P181 (Pump Capacity Time).*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 (view only) |
| Related | • P181 Pump Capacity Time |

To estimate the Pump Rated Capacity (P183), run a pump cycle, and view this parameter. Results are in volume (P051) units or percent per minute of pumped material if Volume has been set. Otherwise results are in units (P005) or percent of span (P007) per minute of pumped material.

# P183 Pump Rated Capacity

*The capacity for which the pump is rated.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 |
| | Preset: 100 |
| Related | • P180 Pump Capacity Reference |

Enter the value in volume (P051) units per minute if Volume has been set. Otherwise, enter the value in level units (P005) per minute.

# P184 Pump Low Efficiency Counter Setpoint

*The number of low efficiency events (P180) before action (P185) takes place.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 |
| | Preset: 3 |
| Related | • P180 Pump Capacity Reference<br>• P185 Pump Low Efficiency Action |

# P185 Pump Low Efficiency Action

*The action taken when the counter (P186) reaches the setpoint (P184).*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | No action |
| | 1 | | Alarm (any relays set for P111=8), set P512=1 |
| | 2 | | Alarm, remove indexed pump from the duty schedule, set P510=1, P512=1 |
| | 3 | | Alarm, remove indexed pump from the duty schedule, set P510=1, P512=1.<br>If all pumps have failed and this pump has only failed on efficiency, then return this pump back to the duty schedule and set P510=0. |
| Alters | • P510 Pump Failed Status<br>• P512 Pump Low Efficiency Fault Status | | |
| Related | • P184 Pump Low Efficiency Counter Setpoint<br>• P186 Pump Low Efficiency Counter | | |

When the action removes a pump from the duty schedule, Pump Low Efficiency Fault (P512) is set. See the description on page 240 for details.

## P186 Pump Low Efficiency Counter

*The current count of low efficiency events.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 (view only) |
| Related | • P180 Pump Capacity Reference<br>• P184 Pump Low Efficiency Counter Setpoint<br>• P185 Pump Low Efficiency Action |

This counter is iterated when the Pump Capacity Reference (P180) value isn't achieved by the indexed pump.

When this value reaches the Pump Low Efficiency Counter Setpoint (P184) then a Pump Low Efficiency Action (P185) is taken.

**The value is reset to 0 when:**

- The Pump Capacity Reference percent is achieved
- P510 is reset

# mA Output (P200 to P219)

These parameters are only available if an Optional I/O card is installed.

## P200 mA Output Range

*Determines the mA output range.*

| | | | |
|---|---|---|---|
| Primary Index | mA output | | |
| Values | 0 | | off |
| | 1 | | 0 to 20 mA |
| | 2 | * | 4 to 20 mA |
| | 3 | | 20 to 0 mA |
| | 4 | | 20 to 4 mA |
| Related | • P911 mA Output Value | | |

If 1 or 2 is selected, the mA output is directly proportional to the mA Function. If 3 or 4 is selected, then the output is inversely proportional.

## P201 mA Output Function

*Use this feature to alter the mA output/measurement relationship.*

| | | | | |
|---|---|---|---|---|
| Primary Index | mA output | | | |
| Values | value | | mA function | Operation (P001) |
| | 0 | * | off | |
| | 1 | | level | Level, Differential, Average, or Sum |
| | 2 | | space | Space |
| | 3 | | distance | Distance |
| | 4 | | volume | Level or Space |
| | 5 | | flow | OCM |
| | 6 | | head | |
| | 7 | | volume rate | |
| | 8 | | mA input | |
| | 9 | | comms input | |
| Related | • P202 mA Output Allocation<br>• P911 mA Output Value | | | |

## P202 mA Output Allocation

*The input source from which the mA output is calculated.*

| | | | |
|---|---|---|---|
| Primary Index | mA output | | |
| Values | 1 | * | Point 1 |
| | 2 | | Point 2 |
| | 3 | | Point 3 |
| Related | • P201 mA Output Function | | |

Enter the Point Number the mA output is to be based upon. This value will depend on whether mA function (P201) is set as transducer or mA input.

If P201 uses a transducer, this parameter can only be altered if P001 (Operation) is set for DPD, DPA, or DPS. The values would be 1 for Single Point applications, 1-2 for Dual Point, or 1-3 for DPD, DPA, or DPS configurations.

If P201 uses mA input, then the values will range from 1 to 5 depending on the optional Analog I/O boards installed.

## P203 mA Output Value / Transducer

*The current mA output value for the Point Number displayed.*

| | |
|---|---|
| Primary Index | Transducer |
| Values | Range: 0.000 to 22.00 (view only) |

This displays as an Auxiliary Reading when 5 mA is pressed in the RUN mode and does not include adjustments made using Trim features (P214 / P215).

**Note:** This parameter is applicable only if any mA output has the transducer Point Number as its input source (see P201 and P202).

# Independent mA Setpoints (P210 and P211)

Use these features to reference the minimum and/or maximum mA output to any point in the measurement range.

| If P201—mA Function is set for… | Then… |
|---|---|
| Level, Space, or Distance, | enter the material level in Units (P005) or percent of Span (P007) as referenced to Empty (P006) |
| Volume, | enter the volume in Max Volume (P051) units or as a percent of Max Volume. |
| Flow | enter the flowrate in OCM Max Flow (P604) units or as a percent of OCM Max Flow. |
| Head | enter the head in level units (P005) or percent of Max Head (P603). |
| volume rate | enter the volume rate in volume / min. Ensure the % symbol is displayed before attempting to enter a % value. |
| Echo mA input or Communication control | these features are not used |

**Note:** The number of indexes showing in the following parameters will be 2, or 4, depending on the optional Analog Input/Output board installed.

## P210 0/4 mA Output Setpoint

*The process level that corresponds to the 0 or 4mA value.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: -999 to 9999 |
| Related | • P211 20 mA Output Setpoint |

Enter the value (in applicable units or %) to correspond to 0 or 4 mA.

## P211 20 mA Output Setpoint

*The process level that corresponds to the 20 mA value.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: -999 to 9999 |
| Related | • P210 0/4 mA Output Setpoint |

Enter the value (in applicable units or %) to correspond to 20 mA.

# mA Output Limits (P212 and P213)

Use these features to adjust the minimum and/or maximum mA output values, which should typically suit the input limit requirements of the external device.

## P212 mA Output Min Limit

*The minimum mA output value (in mA) to be produced.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: 0.000 to 22.00 |
| | Preset: 0.0 or 3.8 |
| Related | • P200 mA Output Range<br>• P213 mA Output Max Limit |

Preset is determined by mA Function (P200). If P200 = 1 or 3, then the preset is 0.0, or if P200 = 2 or 4, then the preset is 3.8.

## P213 mA Output Max Limit

*The maximum mA output value (in mA) to be produced.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: 0.000 to 22.00 |
| | Preset: 20.2 mA |
| Related | • P200 mA Output Range<br>• P212 mA Output Min Limit |

# mA Output Trim (P214 to P215)

This does not affect the P203 value shown, and is used when recalibration of an external device is impractical or an uncalibrated card has been installed.

## P214 4 mA Output Trim

*Used to calibrate the 4 mA output.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: 0 to 9999 |
| Related | • P215 20 mA Output Trim |

Adjust this value so the device indicates 4.000 mA when P214 is accessed.

## P215 20 mA Output Trim

*Used to calibrate the 20 mA output.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: 0 to 9999 |
| Related | • P214 4 mA Output Trim |

Adjust this value so the device indicates 20.00 mA when P215 is accessed.

# mA Output Failsafe (P219)

## P219 mA Output Failsafe

*Use for failsafe operation, independent of the Failsafe Material Level (P071).*

| | | | |
|---|---|---|---|
| Primary Index | mA output | | |
| Values | Range: 0.000 to 22.00 | | |
| | OFF | * | mA output responds to Failsafe Material Level (P071). |
| | HOLd | | the last known value is held until normal operation resumes |
| | LO | | produce the **Empty** mA output immediately. |
| | HI | | produce the **Span** mA output immediately. |
| Related | • P201 mA Output Function | | |

**To select an independent mA Failsafe option:**

1. Press to display the Auxiliary Function symbol,
2. Press or to scroll access the failsafe options.
3. Press when the desired option displayed.

Or, to produce an mA output at a specific value, enter the value required. This is used only if mA output is allocated to a transducer (P201 = 1 to 7).

# mA Input (P250 to P254)

## P250 mA Input Range

*The mA output range of the connected mA device.*

| Primary Index | mA input | | |
|---|---|---|---|
| Values | 1 | | 0 to 20 mA |
| | 2 | * | 4 to 20 mA |

Ensure this range corresponds to the output range of the external device. All level measurements will equate % of Span with the % of the mA range.

## P251 0 or 4 mA Input Level

*The process level or velocity that corresponds to the 0 or 4 mA value.*

| Primary Index | mA input |
|---|---|
| Values | Range: -999 to 9999% |
| | Preset: 0% |
| Related | • P006 Empty<br>• P007 Span |

When using an external mA signal to determine level, the input range must be scaled to give accurate results.

## P252 20 mA Input Level

*The process level or velocity that corresponds to the 20 mA value.*

| Primary Index | mA input |
|---|---|
| Values | Range: -999 to 9999% |
| | Preset: 100% |
| Related | • P006 Empty<br>• P007 Span |

Input range is scaled for accuracy if an external mA signal calculates level

## P253 Input Filter Time Constant

*The time constant used in the mA input filter to dampen signal fluctuations.*

| Primary Index | mA input |
|---|---|
| Values | Range: 0 to 9999 |
| | Preset: 0 |

This number in seconds is used in the damping calculations. Larger values damp more than smaller values and **0** disables the signal filter.

## P254 Scaled mA Input Value

*The resulting level value after scaling.*

| Primary Index | mA input |
|---|---|
| Values | Range: -999 to 9999 %(view only) |
| | Preset: calculated from the input mA signal |

This parameter is calculated from the input mA signal.

# mA Input Trim (P260 to P262)

Your SITRANS LUC500 has been calibrated at the factory, so only use these parameters if you know that it requires recalibration, or if you have installed an optional I/O card yourself.

**Note:** Ignore any values given in P261 4 mA Trim or P262 20 mA Trim.

## P260 mA Raw Input

*Shows the raw mA input supplied by the external device.*

| | |
|---|---|
| Primary Index | mA input |
| Values | Range: 0.000 to 20.00 (view only) |
| Related | • P261 4 mA Trim<br>• P262 20 mA Trim |

## P261 4 mA Trim

*Calibrates the mA input to the bottom (4 mA) level.*

| | |
|---|---|
| Primary Index | mA input |
| Values | Range: 0.000 to 9999 |
| Related | • P260 mA Raw Input<br>• P262 20 mA Trim |

**To calibrate the unit:**

1. Connect a trusted 4 mA source to the mA inputs on the terminal block.
2. Press ↵.
3. L.CAL is shown on the LCD

## P262 20 mA Trim

*Calibrates the mA input to the top (20 mA) level.*

| | |
|---|---|
| Primary Index | mA input |
| Values | Range: 0.000 to 9999 |
| Related | • P260 mA Raw Input<br>• P261 4 mA Trim |

**To calibrate the unit:**

1. Connect a trusted 20 mA source to the mA inputs on the terminal block
2. Press ↵
3. H.CAL is shown on the LCD

# Discrete Input Functions (P270 to P275)

**Discrete inputs can be used for the following:**

- P160 Overflow / Underflow Level Source as described on page 195
- Pump Interlock Allocation (P500 to P509) as described on page 233
- Passing other information to a remote system through communications

Use the parameters listed above to have discrete inputs modify the unit’s operation, use the following parameters to configure the discrete input itself.

See also *Pump Control* on page 84 for a detailed description of the SITRANS LUC500's pump control algorithms, including how the discrete inputs alter its operation.

**Note:** The SITRANS LUC500 base unit has 8 discrete inputs. An optional board can expand this to 16. See *Installing Optional Cards* on page 15 for more details.



# P270 Discrete Input Function

*The way in which discrete signals are interpreted by the SITRANS LUC500.*

| | | | |
|---|---|---|---|
| Primary Index | discrete input | | |
| Values | 0 | | Forced Off |
| | 1 | | Forced On |
| | 2 | * | Normally Open – 0 (DI open), 1 (DI closed) |
| | 3 | | Normally Closed – 0 (DI closed), 1 (DI open) |
| | 4 | | Pulse Counter |
| | 5 | | Frequency Input |
| Related | • Pump Interlock Allocation (P500 to P509)<br>• Pump Control Section<br>• P275 Scaled Discrete Input Value | | |

P270 functions 4 and 5 are only available for the advanced inputs (index 7 and 8). Use the values 0 and 1 to test an installation as they simulate an ON or OFF state. Use 2 and 3 for normal operation. These values can be read by a SCADA system.

# P271 Frequency Input 0Hz Offset

*The value associated with 0 Hz frequency input.*

| | |
|---|---|
| Primary Index | discrete input |
| Values | Range: -999 to 9999 |
| | Preset: 0 (frequency input)<br>---- (for other inputs) |
| Related | • P270 Discrete Input Function |

When the discrete input receives a signal of less than 1Hz, this parameter determines what the scaled value is. This parameter is valid only for discrete inputs set to the **Frequency Input (5)** function.

# P272 Discrete Input Multiplier

*The upper value for Frequency Input or the increment value for a Pulse Counter.*

| | |
|---|---|
| Primary Index | discrete input |
| Values | Range: 0.0 to 9999 |
| | Preset: 1.0 (pulse counter input)<br>100.0 (frequency input)<br>---- (for other inputs) |
| Related | • P270 Discrete Input Function |

This parameter works with both the **Pulse Counter (4)** and the **Frequency Input (5)** functions.

**Pulse Counter (P270 = 4):** Sets the value to iterate for every pulse received. This allows the input value to be scaled as it is totalized. For example, a value of ten (10) here adds 10 to the count for every pulse received.

If you change this value the pulse total (P275) resets to zero (0).

**Frequency Input (P270 = 5)**

Sets the displayed value when the input is at the upper frequency range. Use with P273 Frequency Input Upper Frequency.

# P273 Frequency Input Upper Frequency

*The maximum frequency allowed on a discrete input.*

| | |
|---|---|
| Primary Index | discrete input |
| Values | Range: 0.000 to 20.00 |
| | Preset: 20.0 (frequency input)<br>---- (other) |
| Related | • P270 Discrete Input Function<br>• P272 Discrete Input Multiplier |

Set in kHz, P273 determines when the scaled value shows the value of P272. Frequency inputs greater than the value specified are scaled above P272.

# P274 Frequency Input Filter Time Constant

*The time constant used in the discrete input filter to dampen fluctuations.*

| | |
|---|---|
| Primary Index | discrete input |
| Values | Range: 0.000 to 9999 |
| | Preset: 0 (frequency input)<br>---- (other) |
| Related | • P270 Discrete Input Function |

The number of seconds used in the damping calculations. Larger values damp more than smaller ones. 0 disables the signal filter. This parameter is valid only for discrete inputs set to the **Frequency Input (5)** function.

# P275 Scaled Discrete Input Value

*The current value of the discrete input after any scaling is applied.*

| | | |
|---|---|---|
| Primary Index | discrete input | |
| Values | Display: view only | |
| | Values: dependent on the function of the discrete input | |
| | Range of Values | Function (P270) |
| | 1 | Forced On |
| | 0 | Forced Off |
| | 0 (DI open), 1 (DI closed) | Normally Open |
| | 0 (DI closed), 1 (DI open) | Normally Closed |
| | 0 to 9999 (higher through communications) | Pulse Counter |
| | 0 to 9999 (higher through communications) | Frequency Input |
| Related | • Pump Interlock Allocation (P500 to P509)<br>• Pump Fault Status (P510 to P515)<br>• Pump Control Source (P520 to P524) | |

Readings are updated continuously even in program mode. Frequency inputs can be viewed as percent of P273 by pressing the percent button (▲%) on the hand programmer. Press [C] [↵] to reset the pulse counter (P270 = 4 only).

The value is used by pump interlocks or overflow detection to signal an event. 0 is a logical false and 1 is a logical true.

# Standard Data Logging (P300 to P321)

- To view Data Logging time stamps press and then .
- To view date stamps press and then .

All records can be reset by pressing .

# Record Temperatures (P300 to P303)

These features display a log of record high and / or low temperatures in °C.

When a parameter relating to a TS-3 Temperature Sensor is accessed, the Point Type display changes to the TS-3 symbol. If the unit is powered up without a temperature sensor connected, the value -50 °C is displayed. This information can help trace problems with both built in and external temperature sensors.

## P300 Temperature, Transducer Max

*View the highest temperature encountered, as measured by the temperature sensor in the transducer (if applicable).*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: -50 to +150 °C (view only) |
| | Preset: -50 °C |
| Related | • P301 Temperature, Transducer Min |

Press to reset the log after a short circuit on the transducer wiring.

## P301 Temperature, Transducer Min

*View the lowest temperature encountered, as measured by the temperature sensor in the transducer (if applicable).*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: -50 to +150 °C (view only) |
| | Preset: +150 °C |
| Related | • P300 Temperature, Transducer Max |

Press to reset the log after an open circuit on the transducer wiring.

## P302 Temperature, Sensor Max

*View the highest temperature encountered, as measured by the TS-3 Temperature Sensor (if applicable).*

| | |
|---|---|
| Primary Index | global |
| Values | Range: -50 to +150 °C (view only) |
| | Preset: -50 °C |
| Related | • P303 Temperature, Sensor Min |

Press to reset the log after a short circuit on the transducer wiring.

## P303 Temperature, Sensor Min

*View the lowest temperature encountered, as measured by the TS-3 Temperature Sensor (if applicable).*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | Range: -50 to +150 °C (view only) | |
| | Preset: +150 °C | |
| Related | • P302 Temperature, Sensor Max | |

Press to reset the log after an open circuit on the transducer wiring.

# Record Readings (P304 and P305)

This identifies the occurrence of the record high and low level readings. Press to reset these values once the installation is working correctly.

## P304 Reading Max

*View the highest Reading calculated (in normal Reading units or %).*

| | |
|---|---|
| Primary Index | level |
| Values | Range: -999 to 9999 (view only) |
| Related | • P305 Reading Min |

## P305 Reading Min

*View the lowest Reading calculated (in normal Reading units or %).*

| | |
|---|---|
| Primary Index | level |
| Values | Range: -999 to 9999 (view only) |
| Related | • P304 Reading Max |

# Pump Records (P309 to P312)

These features identify pump usage if the associated Relay Function (P111) is set for any pump control feature. The value displayed pertains to the pump connected to the associated terminals.

Enter a value to set the current record to that value. This can be used if a pump is added with a known number of hours logged or the value can be reset to zero (**0**) after maintenance.

## P309 Pump Run Time

*Displays the amount of time in minutes since a relay was last activated.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 minutes |
| Related | • Relay Function (P111) set for any pump control feature |

This parameter measures the length of time since a relay was asserted, most often to determine how long a pump has been running. Alternatively, it can monitor a relay to show how long it has been in a state of alarm. It is reset every time the relay is activated.

## P310 Pump Hours

*View or reset the accumulated ON time for the displayed Relay Number.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0.000 to 9999 |
| Related | • Relay Function (P111) set for any pump control feature |

This value is displayed with a floating decimal point. (i.e. the more figures displayed before the decimal, the fewer displayed after). It is the value displayed when [2] is pressed in the RUN mode.

## P311 Pump Starts

*View or reset the accumulated number of times the displayed Relay Number has been ON.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 |
| Related | • Relay Function (P111) set for any pump control feature |

This value is displayed when [2] is pressed and held for 5 seconds in RUN mode as described in the section *Operating the SITRANS LUC500* on page 34.

## P312 Pump Run On

*View or reset the accumulated number of times the displayed Relay Number has been held ON via Run On Interval (P130).*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 |
| Related | • Relay Function (P111) set for any pump control feature |

# Overflow / Underflow Records (P313 to P317)

Flow events are logged immediately, so if the system is in overflow state when the overflow records are viewed, then the first record shows the current event. The index contains 20 entries with 1 being the most recent. When more than 20 records are stored, new ones will wrap and write over the oldest ones. These records cannot be reset.

### The following information is recorded:

- Date
- Time
- Duration
- Volume Discharged
- Event Source

### To view Overflow Records

1. Enter Program mode and press [⇔] twice to highlight the index field
   The field shows two underscores _ _
2. Type the index number.
3. Use [▲] and [▼] to scroll through the records

# P313 Overflow/Underflow Event Dates

*View the dates of the 20 most recent events in the format YY:MM:DD.*

| | |
|---|---|
| Primary Index | CSO Log |
| Values | Range: 70:01:01 to 69:12:31 (view only) |
| | Blank entries show as 70:01:01. |
| Related | • Overflow / Underflow (P160 to P169)<br>• P314 Overflow / Underflow Event Times |

**Notes:**
- On rack and panel displays, the year overwrites the index number.
- See page 175 for Date and Time display formats.

# P314 Overflow/Underflow Event Times

*View the times, in 24-hour format HH:MM:SS of the 20 most recent events.*

| | |
|---|---|
| Primary Index | CSO Log |
| Values | Range: 00:00:00 to 23:59:59 (view only) |
| | Blank entries show as 00:00:00. |
| Related | • Overflow / Underflow (P160 to P169) |

On rack and panel displays, the seconds overwrite the index number.

# P315 Overflow/Underflow Event Duration

*View the duration, in minutes of the 20 most recent overflow events.*

| | |
|---|---|
| Primary Index | CSO Log |
| Values | Range: 0.00 to 9999 (view only) |
| | Blank entries show as 0.00. |
| Related | • Overflow / Underflow (P160 to P169) |

# P316 Overflow Event Volume

*Displays the volume discharged in each of the last 20 overflow events.*

| | |
|---|---|
| Primary Index | CSO Log |
| Values | Range: 0 to 9999 (view only) |
| | Default view: ---- |
| Altered By | • P604 Maximum Flow<br>• P606 Time Units<br>• P608 Flowrate Units |
| Related | • P001 Operation<br>• Overflow / Underflow(P160 to P169)<br>• P600 Primary Measuring Device |

**This can be used to calculate volume discharged if:**

- Overflow/Underflow Level Source (P160) is set to monitor for an overflow
- The transducer in Overflow Discharge Volume Source (P166) is set for OCM

If absolute units of measurement have already been selected in Flowrate units (P608 ≠ 0), then Overflow Volume (P316) will be displayed. The time units displayed in P608 are irrelevant here as this material was discharged during an overflow event with a known duration (P315).

If Flowrate units (P608) is set at zero (ratiometric), then the value for Overflow Volume (P316) is shown in the following format:

Flow Units (P604) x Time Units (P606)

**Notes:**
- OCM volume cannot be monitored if the transducer is already set to monitor pumped volume (P001 = 7).
- If Overflow Discharge Volume Source (P166) is disabled (as it is in its default setting), then this parameter will display its default view (----).

## P317 Overflow/Underflow Event Source

*Displays which flow condition caused the flow event.*

| | |
|---|---|
| Primary Index | CSO Log |
| Values | Range: 1-4 (view only) |
| Related | • Overflow / Underflow (P160 to P169) |

# Flow Records (P320 and P321)

These features are enabled if Operation is set for **OCM** (P001 = 6), or an OCM device is defined (P600≠0). Use them to identify the occurrence of the record high and low flow rates as displayed in OCM Max Flow (P604) units, or as a percent of OCM Max Flow. Press [C] [↵] to reset these values once the installation is working correctly.

## P320 Flow Max

*View the highest flow rate calculated (in units or %).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: -999 to 9999 (view only) | |
| Related | • P604 Maximum Flow | |

## P321 Flow Min

*View the lowest flow rate calculated (in units or %).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: -999 to 9999 (view only) | |
| Related | • P604 Maximum Flow | |

# LCD Totalizer (P322 to 327)

Use these parameters to view, reset, or preset the 8 digit display totalizer or negative totalizer when Operation is set for OCM or Pumped Volume (P001 = 6 or 7). The 8 digit totalizer is divided into 2 groups of 4 digits. The 4 least significant totalizer digits are stored in P322 and the 4 most significant digits are stored in P323. Adjust these values separately to set a new total.

Example

| P323 | P322 | Totalizer Display |
|---|---|---|
| 0017 | 6.294 | 00176.294 |

Totalizer units are dependent upon programming. Enter zero **0** (if desired) to reset the totalizer to zero. Alternatively, enter any other (applicable) value, to preset the totalizer to the value desired.

**Note:** A second point is available only if the Dual Point Feature is enabled. See *Enabling Optional Features (P345 to P348)* on page 219 for more details.

# P322 LCD Totalizer Low

*View and / or alter the 4 least significant digits of the totalizer value.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position<br>• P737 Primary Reading | |

# P323 LCD Totalizer High

*View and / or alter the 4 most significant digits of the totalizer value.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position<br>• P737 Primary Reading | |

# P324 LCD Positive Totalizer

*Not displayed on LCD. The positive totalizer combines the LCD Totalizer Low (P322) and LCD Totalizer High (P323) values into an 8 digit totalizer value for data logging. Use this parameter to log the totalizer value.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | global | transducer |
| Values | ---- (not displayed on LCD) | |
| Related | • P322 LCD Totalizer Low<br>• P323 LCD Totalizer High<br>• P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position | |

When viewing log, please refer back to values in P630 (LCD Totalized Multiplier) and P633 (LCD Totalized Decimal Position).

# P325 LCD Negative Totalizer Low

P325 (LCD Negative Totalizer Low), P326 (LCD Negative Totalizer High), and P327 (LCD Negative Totalizer) record totalizer negative flow when using a velocity sensor and OCM functions.

*View and / or alter the 4 least significant digits of the negative totalizer value.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position<br>• P737 Primary Reading | |

## P326 LCD Negative Totalizer High

*View and / or alter the 4 most significant digits of the negative totalizer value.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position<br>• P737 Primary Reading | |

## P327 LCD Negative Totalizer

*Not displayed on LCD. The negative totalizer combines the LCD Negative Totalizer Low (P325) and LCD Negative Totalizer High (P326) values into an 8 digit totalizer value for data logging. Use this parameter to log the negative totalizer value.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Value | ---- (not displayed on LCD) | |
| Related | • P325 LCD Negative Totalizer Low<br>• P326 LCD Negative Totalizer High<br>• P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position | |

When viewing log, please refer back to values in P630 (LCD Totalized Multiplier) and P633 (LCD Totalized Decimal Position).

## P328 Daily Flow Totalizer

*Not displayed on LCD. The daily totalizers are stored with 8 digit resolution. At startup or on date change, the daily and current totals are updated. This total is based on the positive LCD totalizer.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Value | ---- (not displayed on LCD) | |
| Related | • P630 LCD Totalized Multiplier<br>• P633 LCD Totalized Decimal Position | |

# Profile Records (P330 to P333)

⚠ **WARNING: These parameters are for authorized service personnel or Technicians familiar with Siemens Milltronics echo processing techniques.**

These features can record up to 10 Echo profiles, initiated manually (P330), or automatically (P331 et al). See Scope displays (P810) for echo profile viewing hardware /

software requirements. If 10 Profiles are already saved, addresses 1 through 10 are filled, and the oldest automatically initiated record is overwritten. Manually initiated records are not automatically overwritten. All records are automatically deleted in the event of a power interruption.

When a record is displayed, results are based on current programming (which may have been altered since the record was saved). This permits the effect on the echo profile to be observed when changing an echo parameter.

# P330 Profile Record

*Records profiles for later viewing.*

| | | |
|---|---|---|
| Primary Index | echo profile | |
| Values | Code | Description |
| | ---- | no record |
| | A1 | automatically recorded profile from transducer 1 |
| | A2 | automatically recorded profile from transducer 2 |
| | U1 | manually recorded profile from transducer 1 |
| | U2 | manually recorded profile from transducer 2 |

### In addition to being a profile records library, this provides two functions:

- manually records and saves echo profiles
- displays an echo profile, recorded manually or automatically with an oscilloscope.

**To select a record address**

1. Enter Program mode and press twice to highlight the index field
   The field shows two underscores _ _
2. Type the index number. The profile record information is shown
3. Use and to scroll through the records

**To manually record a profile:** Press to fire the transducer and record the echo profile into the internal scope buffer for display.

For differential, average, or sum operation (P001 = 4, 5, or 10), access scope Displays (P810) parameter to select the transducer number.

**To save a manual record:** Press to copy the echo profile record in the scope buffer and save it in the selected address in the record library. The parameter value field displays the new record information.

**To display a record**
Press to enter display auxiliary mode and then:

- Press to display the time the profile was taken
- Press to display the date the profile was taken
- Press to copy the current echo profile into the scope buffer for display on an oscilloscope or Dolphin Plus

**To delete a record**
Press and then to delete the echo profile record in the selected address. The value returns to - - - -.

## P331 Auto Record Enable

*Use this feature to enable / disable the Auto Profile Record function.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 0 to 1 | | |
| | 0 | * | Off |
| | 1 | | On |

## P332 Auto Record Transducer

*Use this feature to specify the Transducer Point Number for which Auto Profile Records are saved.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 0 to 2 | | |
| | 0 | | Any transducer |
| | 1 | * | Transducer 1 |
| | 2 | | Transducer 2 |
| Altered By | • P001 Operation = 4, 5, or 10 | | |

This feature is preset to Point Number 1. (Alteration is only required if **Differential**, **Average**, or **Sum** Operation (P001 = 4, 5, or 10) is selected.

## P333 Auto Record Interval

*Enter the time to elapse after an Auto Profile Record is saved before another Auto Profile Record can be saved (subject to all other restrictions).*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.0 to 9999 (minutes) |
| | Preset: 120 |

# Auto Record ON and OFF Setpoints (P334 to P337)

Use Auto Record ON Setpoint (P334) and Auto Record OFF Setpoint (P335) to define the boundaries within which the level must be, for the resultant Echo Profile to be considered for an Auto Profile Record.

If ---- is displayed for either P334 or P335, Auto Profile Records are saved regardless of current level (subject to all other restrictions).

Enter the level value in Units (P005) or percent of Span (P007) as referenced to Empty (P006).

## P334 Auto Record ON Setpoint

*Enter the critical level which, in conjunction with Auto Record OFF Setpoint, defines the boundaries for Auto Profile Records to be saved.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: -999 to 9999 |
| Related | • P335 Auto Record OFF Setpoint<br>• P336 Auto Record Filling / Emptying<br>• P337 Auto Record LOE Time |

## P335 Auto Record OFF Setpoint

*Enter the critical level which, in conjunction with Auto Record ON Setpoint, defines the boundaries for Auto Profile Records to be saved.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: -999 to 9999 |
| Related | • P334 Auto Record ON Setpoint<br>• P336 Auto Record Filling / Emptying<br>• P337 Auto Record LOE Time |

## P336 Auto Record Filling / Emptying

*Use this feature to restrict Auto Profile Records from being saved unless the level is rising, falling or either.*

<table>
<tr><td>Primary Index</td><td colspan="3">global</td></tr>
<tr><td rowspan="3">Values</td><td>0</td><td>*</td><td>Auto Profile Record on filling or emptying</td></tr>
<tr><td>1</td><td></td><td>Auto Profile Record on filling only</td></tr>
<tr><td>2</td><td></td><td>Auto Profile Record on emptying only</td></tr>
<tr><td>Related</td><td colspan="3">• P334 Auto Record ON Setpoint<br>• P335 Auto Record OFF Setpoint<br>• P337 AutoREcord LOE Time<br>• P702 Filling Indicator<br>• P703 Emptying Indicator</td></tr>
</table>

If the level changes at a rate in excess of the corresponding Filling / Emptying Indicator (P702 / P703) values, the Echo Profile is saved subject to this and other Auto Profile Record restrictions.

## P337 Auto Record LOE Time

*Limits Auto Profile Records from being saved unless extended LOE occurs.*

<table>
<tr><td>Primary Index</td><td>global</td></tr>
<tr><td rowspan="2">Values</td><td>Range: 0.0 to 9999 (seconds)</td></tr>
<tr><td>Preset: 0.0</td></tr>
<tr><td>Related</td><td>• P334 Auto Record ON Setpoint<br>• P335 Auto Record OFF Setpoint<br>• P336 Auto Record Filling / Emptying</td></tr>
</table>

If the LOE condition exceeds the period entered the Echo Profile is saved. When set for **0** LOE is not required for an Auto Profile Record to be saved.

# Installation Records (P340 to P342)

## P340 Date of Manufacture

*View the date of manufacture of this SITRANS LUC500 unit.*

| | |
|---|---|
| Primary Index | global |
| Values | Format: YY:MM:DD (view only) |
| Related | • P341 Run Time<br>• P342 Start Ups |

See page 175 for the Date display format.

## P341 Run Time

*View the number of days this SITRANS LUC500 has been in operation.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 9999 (view only) |
| Related | • P340 Date of Manufacture<br>• P342 Start Ups |

The Run Time value is updated once a day, and cannot be reset. However, in the event of a power interruption, the counter won't advance, so that a unit that is powered down on a regular basis will not have an accurate value.

## P342 Start Ups

*The number of times power has been applied since the Date Of Manufacture.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 9999 (view only) |
| Related | • P340 Date of Manufacture<br>• P341 Run Time |

# Enabling Optional Features (P345 to P348)

## P345 Serial Number, Date Portion

*Date portion of product serial number*

| | |
|---|---|
| Primary Index | global |
| Values | Format: YY:MM:DD |
| Related | • P346 Serial Number<br>• P347 Detected Hardware<br>• P348 Feature Status |

## P346 Serial Number, Numeric Portion

*Numeric portion of product serial number*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 100-999 |
| Related | • P345 Serial Number, Date Portion<br>• P347 Detected Hardware<br>• P348 Feature Status |

## P347 Detected Hardware

*Describes the add-on hardware that the product currently detects.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0000 to FFFF (hex) |
| Related | • P346 Serial Number, Numeric Portion<br>• P345 Serial Number, Date Portion<br>• P348 Feature Status |

**Note: This parameter does not detect SmartLinx cards.**

## P348 Feature Status

*Describes the features that the product currently supports.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0000 to FFFF (hex) |
| Related | • P346 Serial Number, Numeric Portion<br>• P345 Serial Number, Date Portion<br>• P347 Detected Hardware |

# Alarm and Event Trigger System (P420 to P430)

This is an independent software module that can monitor up to 32 separate parameters. It compares the parameter's status to a user-defined setpoint each level cycle, and initiates a predetermined task when it is reached.

**Examples of a software task that the System can launch include:**

- Data Logging
- Report by Exception
- Relay

**Note:** An invalid parameter value will disable the trigger, and set the value to **0** (zero).

## P420 Parameter to Monitor

*The parameter that is being monitored by the Alarm Event Trigger System.*

| | | | |
|---|---|---|---|
| Primary Index | trigger | | |
| Values | Range: 0 to 999 | | |
| | 0 | * | off |
| | 1-999 | | the parameter being monitored |
| Related | • P421 Primary Index to Monitor | | |

When P420 monitors P009 (Time), it is considered a *Periodic Event Trigger.* It will assert when the P009 clock reaches the start time set by P422, and negate at the approximate period midpoint. Trigger asserts will then occur every period as set by P423.

**Note:** The monitored parameter cannot be a **split value** parameter such as P807 – Noise.

The periodic trigger rates specified by P425, P426, and P427 will be applied when P420 = 425. In this mode, P422 still specifies the time when the periodic trigger is to start, but P423 is no longer writeable. When viewed, P423 will reflect the current periodic rate, as determined by P425 to P427.

## P421 Primary Index to Monitor

*The primary index being monitored by the Alarm Event Trigger System.*

| | |
|---|---|
| Primary Index | trigger |
| Values | Range: 1 to 99 |
| Related | • P420 Parameter to Monitor |

The value is the point number of the parameter in P420. Parameters that are indexed globally do not have point numbers, and a 1 should be entered.

# P422 ON Setpoint

| | |
|---|---|
| Primary Index | trigger |
| Values | Format and Range: dependant on parameter |
| Altered By | • P420 Parameter to Monitor |
| Related | • P423 Off Setpoint |

The monitored parameter sets the display format, ex Time (P009) = HH:MM.

# P423 OFF Setpoint

| | |
|---|---|
| Primary Index | trigger |
| Values | Format: dependant on parameter |
| Altered By | • P420 Parameter to Monitor |
| Related | • P422 On Setpoint |

# P424 Trigger State

*Displays the status of the current trigger.*

| | | |
|---|---|---|
| Primary Index | trigger | |
| Values | Format: view only | |
| | 0 | normal |
| | 1 | activated |
| Alters | • P485 Trigger Type | |
| Related | • P420 Parameter to Monitor | |

**Note:** When P111=66, the relay specified in P110 will follow the state of P424. So, if P424=0, the relay will be unasserted. If P424=1, the relay will be asserted.

# P425 Rate Switch

*Defines the rate switch used to determine the rate of the periodic trigger.*

| | |
|---|---|
| Primary Index | trigger |
| Values | trigger source |
| | Range: 1 to 32 |
| Related | • P426 Variable Rate - Low<br>• P427 Variable Rate- High |

# P426 Variable Rate - Low

*Defines the interval between data logs during low rate data logging.*

| | |
|---|---|
| Primary Index | trigger |
| Values | Format and Range: dependant on parameter |
| | Preset: 30 seconds |
| Related | • P423 Off Setpoint |

# P427 Variable Rate- High

*Defines the interval between data logs during high rate data logging.*

| | |
|---|---|
| Primary Index | trigger |
| Values | Format and Range: dependant on parameter |
| | Preset: 30 seconds |
| Related | • P423 Off Setpoint |

## P428 Trigger Status Low

*Displays a 4 digit hex value. Convert to Binary to display the state of triggers 1 to 16.*

| | |
|---|---|
| Primary Index | trigger |
| Values | Format: view only |
| | hex value |
| Related | • P420 Parameter to Monitor<br>• P429 Trigger Status High |

## P429 Trigger Status High

*Displays a 4 digit hex value. Convert to Binary to display the state of triggers 17 to 32.*

| | |
|---|---|
| Primary Index | trigger |
| Values | Format: view only |
| | hex value |
| Related | • P420 Parameter to Monitor<br>• P428 Trigger Status Low |

## P430 Log Trigger

*Configures the Trigger Alarm Logging System.*

| | | | |
|---|---|---|---|
| Primary Index | trigger | | |
| Values | 0 | * | off |
| | 1 | | log every change in this trigger |
| Alters | • P431 Reset Alarm Log | | |
| Related | • P420 Parameter to Monitor | | |

This is related to the Trigger Alarm Logging System (below), and is used to disable the system (0), or set it to log changes in the trigger state (1).

# Trigger Alarm Logging System (P431 to P435)

This records an alarm log for each change to a trigger as set by the Alarm and Event Trigger System (P420 to P430). For it to function, the optional Expansion Memory card must be installed, and the Data Logging option must be enabled (Enabling Optional Features (P345 to P348), page 219). To log an actual value for a watched parameter, then configure the Data Logging Parameters (P440 to P453) as described on page 223.

**The following information is recorded in the alarm log:**

- Trigger number (P432)
- Date/Time stamp (P433)
- Trigger Status (P434)
- Number of Entries in the Log (P435)

## P431 Reset Alarm Log

*Returns the parameter to its default state.*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | 0 | No change |
| | 1 | Reset Log (clears all alarms from log) |
| Altered By | • Enabling Optional Features | |
| Related | • Alarm and Event Trigger System | |

## P432 Last Trigger Logged

*Displays the last alarm or event trigger that was logged.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 32 |
| Altered By | • Enabling Optional Features (P343 to P348) |
| Related | • Alarm and Event Trigger System (P420 to P430) |

The value of this parameter represents the trigger number.

## P433 Date/Time Stamp

*Displays the time that the trigger was activated.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 00:00:00 to 23:59:59 |
| Altered By | • Enabling Optional Features (P343 to P348) |
| Related | • Alarm and Event Trigger System |

See page 175 for the Date and Time display format.

## P434 Trigger Status

*Displays the current state of the trigger.*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | Format: view only | |
| | 1 | Trigger Asserted |
| | 2 | Trigger Negated |
| Altered By | • Enabling Optional Features (P343 to P348) | |
| Related | • Alarm and Event Trigger System | |

## P435 Number Entries

*Displays the number of alarm records that are in the log.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0 to 2880 |
| Altered By | • Enabling Optional Features (P343 to P348) |
| Related | • Alarm and Event Trigger System |

# Data Logging Parameters (P440 to P453)

This works in conjunction with the Alarm and Event Trigger and the Communications Systems to log a record for a pre-defined event. It can monitor up to 10 parameters.

**The following conditions are necessary:**

- Alarm and Event Trigger System (P420 to P430) (page 220) is configured.
- The optional Expansion Memory Card is installed.
- The optional Data Logging Feature is enabled (see page 209).

## P440 Data Logging

*Configures the Data Logging System.*

| | |
|---|---|
| Primary Index | global |

| | | | |
|---|---|---|---|
| Values | 0 | Off | Data logging is not running |
| | 1 | On | Logging, and configuration allowed |
| | 2 | On | Logging but configuration not allowed |
| Altered By | • Enabling Optional Features | | |
| Related | • Alarm and Event Trigger System | | |

# P441 Logged Parameter

*The parameter being recorded by the Data Logging System.*

| | | | |
|---|---|---|---|
| Primary Index | data logging | | |
| Values | Range: 0 to 999 | | |
| | 0 | * | off |
| | 1-999 | | Selected parameter to log |
| Altered By | • Enabling Optional Features (P343 to P348) | | |
| Related | • Alarm and Event Trigger System (P420 to P430)<br>• P420 Parameter to Monitor | | |

Normally, you can read the data of the parameter as if it was displayed on the LCD. If the parameter is a **split value** data type then it must be decoded. See the *Communications* section for details on decoding a split value data type.

**Notes:**

- If the value of P441 is changed, the existing data log is reset.
- P807 Noise cannot be logged.

# P442 Logged Parameter's Primary Index

*The Primary Index that is being recorded by the Data Logging System.*

| | | |
|---|---|---|
| Primary Index | data logging | |
| Values | Range: dependant on parameter being monitored | |
| | 1 | global |
| Altered By | • Enabling Optional Features | |
| Related | • Alarm and Event Trigger System | |

**Note:** If the value of P442 is changed, the existing data log is reset.

# P443 Data Type

*The type of data to be recorded in the log.*

| | | | |
|---|---|---|---|
| Primary Index | data logging | | |
| Values | 0 | | Not Configured |
| | 1 | * | Instantaneous value |
| | 2 | | Averaged value |
| Altered By | • P420 Parameter to Monitor<br>• Enabling Optional Features (P343 to P348) | | |
| Related | • Alarm and Event Trigger System (P420 to P430) | | |

The instantaneous value occurs at the time of the trigger. The Averaged value can only be used when a periodic trigger is set at regular intervals (P420=9, see *P420 Parameter to Monitor* on page 220). The logged data is an average of all readings, and updated each time the trigger is activated.

# P444 Log Storage Type

*The method in which the data is stored in the log.*

| | | | |
|---|---|---|---|
| Primary Index | data logging | | |
| Values | 0 | * | Inactive/Full |
| | 1 | | circular |
| | 2 | | fill and stop |
| Altered By | • Enabling Optional Features (P343 to P348) | | |
| Related | • Alarm and Event Trigger System (P240 to P430)<br>• P447 Log Reset | | |

If this parameter is set to zero (0), then no logging will occur. If the circular storage type is chosen (1), then new entries will overwrite old ones when the log is full. If the fill and stop option is selected (2), then logging will cease once capacity is reached and the value is set to 0. The log must be reset in order to begin collecting data again (see P447). A log can be disabled or paused by setting it to 0, and will continue where it left off when reactivated.

# P445 Data Log Trigger

*Sets the trigger number that will activate the logging system*

| | |
|---|---|
| Primary Index | data logging |
| Values | Range: 0 to 32 |
| Altered By | • Enabling Optional Features |
| Related | • Alarm and Event Trigger System |

This refers to the *Alarm and Event Trigger System (P420 to P430)* on page 220. The value of P445 will be equal to the trigger number that is the primary index of parameters P420 to P430. For example, if P420[7]=009, then this would be considered trigger #7, so the value of P445 should be set to 7.

# P446 Trigger Type

*Specifies the trigger state that will activate the Data Logging System.*

| | | | |
|---|---|---|---|
| Primary Index | data logging | | |
| Values | 1 | * | Trigger Activated |
| | 2 | | Trigger Negated |
| | 3 | | Both |
| Altered By | • Enabling Optional Features | | |
| Related | • Alarm and Event Trigger System | | |

1. P446 = 1 will initiate a log when the trigger is turned on.
2. P446 = 2 will initiate a log when the trigger is turned off.
3. P446 = 3 will log one report when turned on, and another when turned off.

# P447 Log Reset

*Resets the Data Logging System.*

| | | |
|---|---|---|
| Primary Index | data logging | |
| Values | Range: 0 to 1 | |
| | 0 | No change |
| | 1 | Reset log |
| Altered By | • Enabling Optional Features (P343 to P348)<br>• P444 Log Storage Type | |
| Related | • Alarm and Event Trigger System (P420 to P430) | |

When a value of 1 is entered, the log will reset, and all data is cleared.

# P450 Last Reading

*Displays the last logged value for the data log.*

| | |
|---|---|
| Primary Index | data logging |
| Values | Display: dependant on logged parameter |
| Altered By | • Enabling Optional Features (P343 to P348) |
| Related | • Alarm and Event Trigger System (P420 to P430)<br>• P451 Last Reading Time Stamp |

# P451 Last Reading Time Stamp

*Displays the time that the last reading was logged.*

| | |
|---|---|
| Primary Index | data logging |
| Values | Range: 00:00:00 to 23:59:59 |
| Altered By | • Enabling Optional Features (P343 to P348) |
| Related | • Alarm and Event Trigger System (P420 to P430)<br>• P450 Last Reading |

See page 201 for Time display format.

# P452 Number of Entries

*Displays the number of entries in the data log.*

| | |
|---|---|
| Primary Index | data logging |
| Values | Range: 0 to 5000 |
| Altered By | • Enabling Optional Features (P343 to P348)<br>• P447 Log Reset |
| Related | • Alarm and Event Trigger System (P420 to P430) |

The maximum value is 5000 (even in a circular queue), and is set to 0 when the log is reset (see *P447 Log Reset* on page 226).

# P453 Log Status

*Displays the trigger state responsible for data logging.*

| | | |
|---|---|---|
| Primary Index | data logging | |
| Values | Format: view only | |
| | 0 | Inactive/Full |
| | 1 | Active (Trigger Activated) |
| | 2 | Active (Trigger Negated) |
| Altered By | • Enabling Optional Features (P343 to P348) | |
| Related | • Alarm and Event Trigger System (P420 to P430)<br>• P446 Trigger Type | |

# Statistical Calculations (P454 to P458)

These parameters generate statistical information from logged data.

## P454 Statistics Log

*Determines which log will be used for statistical calculations.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 10 |
| Alters | • P455 Statistic Type |
| Related | • Data Logging Parameters (P440 to P453) |

## P455 Statistic Type

*Selects the type of statistical data the user wants to view.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | Current Trigger Period |
| | 1 | | Current Hour |
| | 2 | | Current Day |
| | 3 | | Current Week |
| | 4 | | Current Month |
| | 5 | | Previous Hour |
| | 6 | | Previous Day |
| | 7 | | Previous Week |
| | 8 | | Previous Month |
| | 9 | | Previous 60 minutes |
| | 10 | | Previous 24 hours |
| Related | • Data Logging Parameters (P440 to P453) | | |

Values 9 and 10 are statistical values (average, minimum and maximum) derived from values stored in the log, and not individual readings.

**Note:** These statistics can take a considerable amount of time to generate.

## P456 Averaged Value

*Displays the Averaged Value of the selected data log.*

| | |
|---|---|
| Primary Index | global |
| Values | Format: dependant on the type of data being logged. |
| Altered By | • P454 Statistics Log<br>• P455 Statistic Type |
| Related | • Data Logging Parameters (P440 to P453) |

This parameter will display the statistical value that is set in P455 (Statistic Type) for the data log that is specified in P454 (Statistics Log). The units displayed are relative to the parameter being logged.

**Note:** This parameter cannot be used to average time or date parameters.

## P457 Minimum Value

*Displays the minimum value for the parameter being logged.*

| | |
|---|---|
| Primary Index | global |

| | |
|---|---|
| Values | Format: -999 to 9999 |
| Altered By | • P455 Statistic Type |
| Related | • Data Logging Parameters (P440 to P453)<br>• P458 Maximum Value |

This parameter records and displays the minimum value of the watched parameter during the reading time as specified in P455 (Statistic Type). The units displayed are relative to the parameter being logged.

## P458 Maximum Value

*Displays the maximum value for the parameter being logged.*

| | |
|---|---|
| Primary Index | global |
| Values | Format: -999 to 9999 |
| Altered By | • P455 Statistic Type |
| Related | • Data Logging Parameters (P440 to P453)<br>• P457 Minimum Value |

This parameter records and displays the maximum value of the watched parameter during the reading time as specified in P455 (Statistic Type). The units displayed are relative to the parameter being logged.

# Report by Exception (P470 to P472)

Use these parameters to configure the SITRANS LUC500 Report by Exception System to alert a SCADA system or HMI to a defined event. Up to 32 separate parameters can be monitored using this system with alerts sent through a modem or a direct RS-232 or RS-485 connection.

### The information included in a report to a host machine includes:

- The numeric unit identifier
- The date and time that the exception occurred
- The number and type of exception
- A user-defined value from the watched parameter

**Note:** The Report by Exception System will not operate unless the Alarm and Event Trigger System (P420 to P430) on page 220 is properly configured.

## P470 Unit identifier

*The numeric identifier that is unique to this SITRANS LUC500 unit.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | disables report by exception |
| | 1 to 9999 | | unit identifier value |
| Altered By | • Alarm and Event Trigger System (P420 to P430) | | |
| Related | • Modbus Master (P473 to P476) | | |

This numeric identifier is defined by the user, and is contained in the report that is transmitted from this SITRANS LUC500 unit to identify the source of the transmission to the host. A value of zero (**0**) in this parameter disables the Report by Exception System.

# P471 Report by Exception Destination

*Selects the communications port to be used.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | disables report by exception |
| | 1 | | RJ-11 |
| | 2 | | Terminal Block (RS-232) |
| | 3 | | RS-485 |
| Related | • Enabling Optional Features (P345 to P348) | | |

A value of zero (**0**) disables reporting of exceptions, but they can still be generated and stored in the Modbus Map. For the report to be read, the remote host must initiate a connection.

The Report by Exception system uses triggers to initiate a report and polling from external hosts can be used to retrieve it. This is especially relevant when the SITRANS LUC500 is configured as a slave, as the Modbus master will not pre-empt the slave.

> **Note:** Use of RS-485 (P471=3) requires an optional card. Contact your Siemens Milltronics representative to obtain the card, and install it as described in the *Installation* section beginning on page 6.

# P472 Error Status

*Displays the status of the last exception that was generated.*

| | |
|---|---|
| Primary Index | global |
| Values | See tables below |
| Related | Modbus Master (P473 to P476) |

### Error Codes as Reported by an Unsolicited Slave

| Code | Name | Meaning |
|---|---|---|
| 0 | Successful | Connection took place. This is the default. |
| 1-99 | Driver generated error | Exception codes are placed here by the Modbus Master. See the *Communications Reference* section for details. |
| 100 | Could Not Connect | The connection attempt has failed, but more numbers will be tried. |
| 105 | All Connection Attempts Failed | No further attempts will be made to send this exception, but it can still be retrieved if the unit is polled before another exception occurs. |

### Error Codes as Reported by a Master

| Code | Name | Meaning |
|---|---|---|
| 101 | Unrecognized Message | The transmission could not be recognized as a valid message.<br>Possible causes:<br>CRC/LRC Errors<br>Incomplete Messages<br>Wrong or incorrectly formatted protocol |
| 102 | Stopped Driver Before Reply | The Master was waiting for a reply, but the driver was stopped before it came. |
| 103 | Time Out Error | The Master timed out while waiting for a reply, but is still trying. |
| 104 | Failed Retries | All Tries have failed. If a modem is attached, then the next number is tried. Otherwise, this is the final failure message. |
| 106 | Unexpected Message | The Master received a message it did not expect<br>Possible causes:<br>Slave responded after Master timed out (increase timeout)<br>Another Master is connected<br>(only 1 Master is allowed) |

# Modbus Master (P473 to P476)

## P473 Slave address

*This is the Modbus Address of the slave that the unit will send messages to.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 0 to 247 | | |
| | 0 | * | Broadcast |
| | 1-247 | | Slave Address |
| Related | • Report by Exception (P470 to P472) | | |

## P474 Slave start register

*The start address in the slave's 4x-register area that the unit will write to.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 9999 (default = 1) |
| Related | • Report by Exception (P470 to P472) |

The value is added to 40000 to determine the destination address.

## P475 Number of tries

*The number of attempts that the unit will make to connect.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | Non-stop |
| | 1-9999 | | The number of tries |
| Altered By | • P743 Slave Address | | |
| Related | • Report by Exception (P470 to P472)<br>• P476 Timeout Delay | | |

If P473 Slave address is set to zero (**0**), then this parameter is ignored.

## P476 Timeout delay

*Determines the time that the unit will wait for replies before timing out.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 9999 milliseconds |
| | Default = 3000 or 3 seconds |
| Altered By | • P743 Slave Address |
| Related | • Report by Exception (P470 to P472)<br>• P475 Number of Tries |

If P473 Slave address is set to zero (**0**), then this parameter is ignored.

# Report Generation (P481 to P485)

Use these parameters to configure the Report Generation system.

**The following conditions can be determined:**

- the parameter and primary index to be reported on
- the format in which the data is transmitted
- the trigger that is monitored in order to generate a report
- the state that the trigger is in that will generate a report.

# P481 Report Generation Parameter

*Selects the Parameter number to be reported on.*

| | | | |
|---|---|---|---|
| Primary Index | report | | |
| Values | 0 | | disabled |
| | 1-999 | | Selected parameter to report on |
| Related | • Alarm and Event Trigger System (P420 to P4030) | | |

# P482 Report Generation Primary Index

*Selects the primary index of the Parameter to be reported on.*

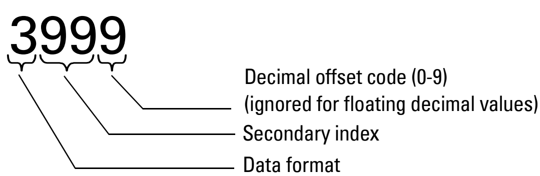
| | |
|---|---|
| Primary Index | report |
| Values | Range: dependant on parameter being reported on. |
| | Default: 1 |
| Related | • Alarm and Event Trigger System (P420 to P430) |

Value is tied to the number of indexes of the parameter being reported on.

# P483 Report Generation Format

*Determines how the data is transmitted.*

| | |
|---|---|
| Primary Index | report |
| Values | Range: 0 to 3999 (see below for format) |
| Related | • Alarm and Event Trigger System (P420 to P430) |




This is the format of the parameter as defined by the decimal offset for the format registers in the Modbus register map. See Format Registers on page 150 for a description of the decimal offset code.

Data format:

| Data Format Digit | Meaning |
|---|---|
| 0 | integer, most significant word first |
| 1 | float, most significant word first |
| 2 | integer, least significant word first |
| 3 | float, least significant word first |

# P484 Trigger Number

*Sets the trigger number used to initiate an exception.*

| | | | |
|---|---|---|---|
| Primary Index | report | | |
| Values | Range: 0 to 32 | | |
| | 0 | | No trigger number used |
| Altered By | • P420 Parameter to Monitor | | |
| Related | • Alarm and Event Trigger System (P420 to P430) | | |

This refers to the Alarm and Event Trigger System (P420 to P430) on page 220. The value of P484 will be equal to the trigger number that is the primary index of parameters P420 to

P430. For example, if P420[7]=009, then this would be considered trigger #7, so the value of P484 should be set to 7.

# P485 Trigger Type

*Indicates the trigger state that initiates a report.*

| | | | |
|---|---|---|---|
| Primary Index | report | | |
| Values | Range: 1 to 3 | | |
| | 1 | | Trigger Activated |
| | 2 | | Trigger Negated |
| | 3 | | Both |
| Altered By | • P424 Trigger State | | |
| Related | • Alarm and Event Trigger System (P420 to P430)<br>• P422 On Setpoint<br>• P423 Off Setpoint | | |

### If P424 is set for an activated Trigger State, then P485 can be as follows:

1. P485 = 1 will initiate a log when the trigger is turned on.
2. P485 = 2 will initiate a log when the trigger is turned off.
3. P485 = 3 will log one report when turned on, and another when turned off.

# P486 Carrier Detection

*Determines how the SITRANS LUC500 will detect for communications carrier before sending a Report by Exception.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | | No carrier detection |
| | 1 | * | DCD – modem |
| | 2 | | Rx activity – network |

### No Carrier Detection

This option turns off the communication delay. The SITRANS LUC500 will attempt to issue a report by exception without first checking for existing communications (the timings from P487 and P488 still apply).

### DCD Method

Use the DCD method when the SITRANS LUC500 communicates through a modem. This method waits until the modem is hung up before attempting to communicate out.

### Rx Activity Method

Use the Rx Activity method when the SITRANS LUC500 is permanently connected to an RS-486 multi-drop network.

**Note:** The reporting system will not override a communication in progress (for example a SCADA system downloading information) to issue the report. It will always wait until the communication is complete.

## P487 Minimum Quiet Time

*Specifies the time, in ms, that the SITRANS LUC500 will wait before initiating an unsolicited Report by Exception.*

| | | |
|---|---|---|
| Primary Index | communications port | |
| Values | Range: 0-10000 milliseconds | |
| | Preset: 1000 | |

When the Report by Exception subsystem has a report to issue it will begin watching the communications carrier (as defined by P486) for a suitable quiet time. Once the time has elapsed, default is 1 second, then the Report by Exception subsystem will begin working.

All Modbus master parameters (P473 to P476) are used when the SITRANS LUC500 is acting as a master.

## P488 Holding Time Constant

Specifies the time, in ms, that the SITRANS LUC500 will wait after the Minimum Quiet Time before issuing Modbus master commands.

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 0-2000 milliseconds |
| | Preset: 100 |

When the Minimum Quiet Time has elapsed then the Holding Time begins. This constant is used so that if there are multiple SITRANS LUC500's on the network they will not try to initiate communications simultaneously and cause collisions.

# Pump Interlock Allocation (P500 to P509)

Discrete inputs allow you to feed pump information to the SITRANS LUC500 so that it can modify pump algorithms. See the sections on *Pump Control* or *Discrete Inputs* for more information.

All of these parameters are indexed by pump relay. All relays are available for indexing but only those set to pump control in the Relay Control Function (P111 = 50 to 56) will be affected by these parameters. For most pump applications only a simple discrete input is required. Inputs 7 and 8 can be used but must be configured as P270 = 3 or 4.

When a pump is determined to be in failed state the appropriate Pump Fault Status (P510 to P515) parameter (page 238) is set to one (1) and any programmed actions take place.

**Note:** The SITRANS LUC500 base unit has eight (8) discrete inputs. An optional board can expand this number to 16. Refer to the *Installation* section for instructions on the proper installation and wiring of this optional board.

**See also:**


- *Connecting Pump Control Interlocks* on page 86.
- *Pump Fault Status (P510 to P515)* on page 238
- *Pump Control Source (P520 to P524)* on page 241
- *Pump Control* on page 84.
- *Discrete Inputs* on page 53.

# P500 Pump Auto Allocation

*Determines whether the indexed pump relay is controlled by the SITRANS LUC500 or by a manual override switch.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | No override switch |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P520 Pump Available<br>• P521 Pump in Local Auto | | |
| Related | • P275 Scaled Discrete Input Value<br>• P270 Discrete Input Function | | |

A value of zero (**0**) indicates that the pump relay does not use a physical manual override switch. A value of 1 to 8 (or 16) indicates the discrete input that is set to watch for auto or manual status.

With P270 as preset (NO circuit), the value generated by the discrete input (P275) is interpreted:

| P275 Value | P500 Meaning |
|---|---|
| 0 | Pump in manual |
| 1 | Pump in auto |

**Note:** P500 is reversed from most other interlock parameters; 1 is the normal state and 0 is the exception state.

**Example:** If a three-position Run/Off/Auto switch is connected to discrete input 3 with the following contacts:

| Switch Position | Discrete Input #3 Circuit |
|---|---|
| Run | Open |
| Off | Open |
| Auto | Closed |

Then, for an SITRANS LUC500 with three pumps, the following parameters would be set

| Parameter | Index | Value | Description |
|---|---|---|---|
| P500 | 1 | 3 | |
| P500 | 2 | 3 | Sets all three pumps to respect the switch position. |
| P500 | 3 | 3 | |
| P270 | 3 | 2 | Auto operation = closed circuit |

# P501 Pump Remote Control Allocation

*Determines whether remote access to pump control is enabled.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | No Discrete Inputs used |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P515 Pump Remote Control Status | | |
| Related | • P275 Scaled Discrete Input Value | | |

A value of 0 indicates that no discrete inputs are used. In this case P515 Pump Remote Control Status defaults to 0 and can be set through communications. A value of 1 to 16 indicates the discrete input being used to watch for remote control status.

When remote control is disabled then remote hosts cannot affect pump control directly. See the SITRANS LUC500 *Communications* section for more information on controlling the device from a remote system.

The value is reported in P515 and comes from P275 indexed to the specified input.

| P275 Value | P501 Meaning |
|---|---|
| 0 | Pump in local only |
| 1 | Pump available for remote control |



# P502 Power Failure Allocation

*Determines if the site is experiencing a power failure.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | no discrete inputs used |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P519 Power Failure Status | | |
| Related | • P275 Scaled Discrete Input Value<br>• Power Failure Alarm (P111=12) | | |

Use this parameter when the SITRANS LUC500 is supplied with backup power and the pumps are not. The specified Discrete Input supplies its power status to P275 Scaled Discrete Input Value which in turn passes the information on to P502.

| P275 Value | P502 Meaning |
|---|---|
| 0 | Power normal |
| 1 | Power failure detected |

### If a power failure is detected:

- A power failure event is initiated and any relays set for power failure alarm (P111 = 12) are triggered
- All new pump alarms are ignored (existing alarms remain in effect)
- Pumps are stopped

### When the power resumes and the discrete input returns to its normal state:

- The power failure event ends and alarms are reset
- The pumps start based on their setpoints (P112 and P113) and the delay parameters (P132 and P133)
- The value is reported in P519 Power Failure Status.

# P503 Pump Run Status Allocation

*Determines whether the indexed pump is running.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | Pump does not use a pump interlock |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P511 Pump Run Fault Status | | |
| Related | • P275 Scaled Discrete Input Value<br>• P504 Pump Run Status Time Delay | | |

When SITRANS LUC500 activates a pump relay it assumes that the pump is running. To verify this assumption a circuit can be set up to confirm the run status from the motor starter to a discrete input.

A value of **0** indicates that the pump does not use a running interlock. A value of **1** to **16** forces the discrete input to watch for running status.

The specified Discrete Input supplies the value of the interlock to P275 Scaled Discrete Input Value which in turn passes the value on to P503.

| P275 Value | P503 Meaning |
|---|---|
| 0 | Pump not running |
| 1 | Pump running |

The value of this fault is then reported to P511 Pump Run Fault Status.

If the pump is activated by the SITRANS LUC500 and the Run Status input is not set then the SITRANS LUC500 assumes that the pump has failed and will remove that pump from the duty cycle.

# P504 Pump Run Status Time Delay

*Specifies the time, in seconds, between when the SITRANS LUC500 commands a pump to run and when it starts checking the status of the discrete input.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0000 to 9999 |
| | Preset: 5 (sec) |
| Related | • P503 Pump Run Status Allocation |

To use this time delay a relay must have P503 Pump Run Status Allocation set to a discrete input.

Once the unit is instructed to check the status of the discrete input, it will continue to do so as long as the pump has been commanded to run.

# P505 Pump Fault A Allocation

*Detects whether there is a fault on the indexed pump.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | Pump does not use fault interlocks |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P513 Pump Fault A Status | | |
| Related | • P275 Scaled Discrete Input Value | | |

When a pump is capable of reporting faults in operation it can be connected to a discrete input and this information can be used by SITRANS LUC500 to modify its pump control algorithms.

A value of zero (**0**) indicates that the pump does not use fault interlocks. A value of **1** to **16** indicates the discrete input to watch for operation status.

The specified Discrete Input supplies the value to P275 Scaled Discrete Input Value which in turn passes the information on to P505.

| P275 Value | P505 Meaning |
|---|---|
| 0 | Pump ok |
| 1 | Pump in fault condition |

When the pump enters a fault condition it is removed from the duty cycle.

# P506 Pump Fault B Allocation

*Detects whether there is a fault on the indexed pump.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | Pump does not use fault interlocks |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P514 Pump Fault B Status | | |
| Related | • P275 Scaled Discrete Input Value | | |

When a pump is capable of reporting faults in operation it can be connected to a discrete input and this information can be used by SITRANS LUC500 to modify its pump control algorithms.

A value of zero (**0**) indicates that the pump does not use fault interlocks. A value of 1 to 16 indicates the discrete input to watch for operation status.

The specified Discrete Input supplies the value to P275 Scaled Discrete Input Value which in turn passes the information on to P506.

| P275 Value | P506 Meaning |
|---|---|
| 0 | Pump ok |
| 1 | Pump in fault condition |

When the pump enters a fault condition it is removed from the duty cycle.

# P507 Pump Fault C Allocation

*Detects whether there is a fault on the indexed pump.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | Pump does not use fault interlocks |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P516 Pump Fault C Status | | |
| Related | • P275 Scaled Discrete Input Value | | |

When a pump is capable of reporting faults in operation it can be connected to a discrete input and this information can be used by SITRANS LUC500 to modify its pump control algorithms.

A value of zero (**0**) indicates that the pump does not use fault interlocks. A value of 1 to 16 indicates the discrete input to watch for operation status.

The specified Discrete Input supplies the value to P275 Scaled Discrete Input Value which in turn passes the information on to P507.

| P275 Value | P507 Meaning |
|---|---|
| 0 | Pump ok |
| 1 | Pump in fault condition |

When the pump enters a fault condition it is removed from the duty cycle.

Pump Fault C Allocation will detect a pump fault only when the pump is running. Pump Fault A and B Allocations will detect a pump fault when the pump is running or quiet.

## P508 Pump Fault C Timer

*Time after pump start that the discrete input indicated by P507 will first be tested.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 9999 seconds |
| | Preset: 0 seconds |
| Related | • P507 Pump Fault C Allocation |

## P509 Pump Reset Allocation

*Resets the pump fault status parameters using a momentary contact.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | No Discrete Input watched for reset |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |
| Alters | • P510 Pump Failed Status | | |
| Related | • P275 Scaled Discrete Input Value | | |

When a contact is made on the referenced discrete input all pump faults are reset for the indexed pump and that pump is put back into the duty schedule.

A value of zero (**0**) indicates that no discrete inputs are watched for reset. In this case any pump faults must be reset using the hand programmer and P510 or through communications. A value of 1 to 16 indicates the discrete input to watch for pump reset.

To allow the contact to reset all pumps use index zero (**0**).

The discrete input only works in RUN or simulation modes and is triggered by the change in state of P275 from 0 to 1.

# Pump Fault Status (P510 to P515)

Use these parameters to determine which condition failed the indexed pump. All relays are available for indexing but only those set to pump control in the Relay Control Function (P111 = 50 to 56) will be affected by these parameters. Once the cause of the failure condition is fixed, use a push button connected to a discrete input (P509) or the parameter P510 to reset a failure condition.

Once back in RUN mode, if the indexed pump relay symbol stops flashing on the LCD, that pump has returned to normal status. If it keeps flashing, there is still a failure reported, or the pump is still in manual mode, and the pump relay will not be used.

All of these parameters are latched and will not reset automatically. Use P510 to reset all status parameters for an indexed pump relay.

To reset the fault status, change the parameter value to 0

# P510 Pump Failed Status

*Reports whether the indexed pump has failed and allows for reset.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | normal operation |
| | 1 | | pump failed |
| Alters | • P186 Pump Low Efficiency Counter<br>• P511 Pump Run Fault Status<br>• P512 Pump Low Efficiency Fault Status<br>• P513 Pump Fault A Status<br>• P514 Pump Fault B Status<br>• P516 Pump Fault C Status | | |
| Altered By | • P509 Pump Reset | | |
| Related | • P503 Pump Run Status Allocation<br>• P505 Pump Fault A Allocation<br>• P506 Pump Fault B Allocation<br>• P507 Pump Fault C Allocation<br>• P185 Pump Low Efficiency Action | | |

When any of the other status parameters (listed below) is set to 1 (failed) then this parameter is also set to 1. The parameter is indexed by relay.

Before resetting this parameter to 0, check the other 510-series parameters to determine which one caused the fault. This parameter will show a **1** rather than a **0**.

When a pump fails the value for the indexed relay changes from 0 to 1. It remains in failed state (1) until reset through communications, the hand programmer, or a push button connected to a discrete interlock (P509).

Reset this latched parameter by changing the indexed value to 0.

### Resetting this parameter resets all of these other parameters to 0:

- P510 Pump Failed Status
- P511 Pump Run Fault Status
- P512 Pump Low Efficiency Fault Status (from P185)
- P513 Pump Fault **A** Status
- P514 Pump Fault **B** Status
- P516 Pump Fault **C** Status
- P186 Pump Low Efficiency Counter

# P511 Pump Run Fault Status

*Reports status of P503 Pump Run Status Allocation after P504 Pump Run Status Time Delay has expired.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | normal operation |
| | 1 | | fault detected |
| Alters | • P510 Pump Failed Status | | |
| Altered By | • P503 Pump Run Status Allocation | | |
| Related | • P504 Pump Run Status Time Delay | | |

# P512 Pump Low Efficiency Fault Status

*Reports pump efficiency status based on efficiency calculations.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | normal operation |
| | 1 | | fault detected |
| Alters | • P510 Pump Failed Status | | |
| Altered By | • P185 Pump Low Efficiency Action | | |
| Related | • Pump Efficiency (P180 to P186) | | |

See *Pump Efficiency (P180 to P186)* on page 199. The value of P185 Pump Low Efficiency Action determines how these parameters are updated:

| P185 value | Updated Parameters |
|---|---|
| 0 – no action | no action |
| 1 – Alarm | P512 = 1 |
| 2 – Alarm and fail pump | P510 = 1, P512 = 1 |

# P513 Pump Fault A Status

*Reports status of P505 Pump Fault **A** Allocation.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | normal operation |
| | 1 | | fault detected |
| Alters | • P510 Pump Failed Status | | |
| Altered By | • P505 Pump Fault A Allocation | | |
| Related | • P275 Scaled Discrete Input Value | | |

# P514 Pump Fault B Status

*Reports status of P506 Pump Fault **B** Allocation.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | normal operation |
| | 1 | | fault detected |
| Alters | • P510 Pump Failed Status | | |
| Altered By | • P506 Pump Fault **B** Allocation | | |
| Related | • P275 Scaled Discrete Input Value | | |

# P515 Pump Remote Control Status

*Reports status of P501 Pump Remote Control Allocation or remote control bit.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | pump in local mode, remote disabled |
| | 1 | | pump in remote mode, remote enabled |
| Altered By | • P501 Pump Remote Control Allocation | | |
| Related | • P275 Scaled Discrete Input Value | | |

If P501 Pump Remote Control Allocation is used then this parameter reports the result of the discrete input and is view only. If P501 is not used then this parameter reports the value of the remote control bit which is set in communications. See *Communications* section for details.

## P516 Pump Fault C Status

*Reports status of P507 Pump Fault C Allocation*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | pump in local mode, remote disabled |
| | 1 | | pump in remote mode, remote enabled |
| Alters | • P510 Pump Failed Status | | |
| Altered By | • P507 Pump Fault **C** Allocation | | |
| Related | • P275 Scaled Discrete Input Value | | |

If P501 Pump Remote Control Allocation is used then this parameter reports the result of the discrete input and is view only. If P501 is not used then this parameter reports the value of the remote control bit which is set in communications. See *Communications* section for details.

## P519 Power Failure Status

*Reports the status of P502 Power Failure Allocation.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Format: view only | | |
| | 0 | * | power available |
| | 1 | | power failure |
| Altered By | • P502 Power Failure Allocation | | |
| Related | • P275 Scaled Discrete Input Value<br>• Power Failure Alarm (P111 = 12) | | |

# Pump Control Source (P520 to P524)

These parameters determine where the pump relays are controlled:

| | Auto | Manual |
|---|---|---|
| **Local** | P521 | P522 |
| **Remote** | P523 | P524 |

## P520 Pump Available

*Indicates whether the pump is available to the pump control routines.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | | pump not available |
| | 1 | * | pump available |
| Altered By | • P510 Pump Failed Status<br>• P521 Pump in Local Auto<br>• P522 Pump in Local Manual<br>• P523 Pump in Remote Auto<br>• P524 Pump in Remote Manual | | |

A pump is not available in *manual* mode or there is a fault in the discrete inputs.

# P521 Pump in Local Auto

*Control of the indexed pump is through the pump control algorithms.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | | pump not in local / auto |
| | 1 | * | pump in local / auto |
| Related | • P520 Pump Available<br>• P510 Pump Failed Status<br>• P522 Pump in Local Manual<br>• P523 Pump in Remote Auto<br>• P524 Pump in Remote Manual | | |

See *Pump Control* on page 84 for more information.

# P522 Pump in Local Manual

*Indicates that control of the indexed pump is exclusively from a discrete input.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | pump not in local / auto |
| | 1 | | pump in local / manual |
| Related | • P520 Pump Available<br>• P510 Pump Failed Status<br>• P521 Pump in Local Auto<br>• P523 Pump in Remote Auto<br>• P524 Pump in Remote Manual | | |

Usually a three-way (on-off-auto) switch mounted near the SITRANS LUC500 is used to put the unit into Local Manual mode and to control the pump.

# P523 Pump in Remote Auto

*Indicates that control of the indexed pump is from the SITRANS LUC500 pump control algorithms and that remote control is enabled.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | Format: view only | | |
| | 0 | * | pump not in remote / auto |
| | 1 | | pump in remote / auto |
| Related | • P520 Pump Available<br>• P510 Pump Failed Status<br>• 521 Pump in Local Auto<br>• P522 Pump in Local Manual<br>• P524 Pump in Remote Manual | | |

See *Communications* section for details on the pump controls available through communications.

## P524 Pump in Remote Manual

*Control of the pump is through communications from a remote system.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | pump not in remote / manual |
| | 1 | | pump in remote / manual |
| Related | • P520 Pump Available<br>• P510 Pump Failed Status<br>• P521 Pump in Local Auto<br>• P522 Pump in Local Manual<br>• P524 Pump in Re mote Manual | | |

See *Communications* section for more information.

# Pump Faults (P541 to P559)

## P541 Pump Running Fault Timer

*Indicates the length of time the pump running fault indicator must be asserted before the SITRANS LUC500 will flag a pump fault.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0000 to 9999 seconds |
| | Preset: 0 (sec) |
| Related | • P543 Pump Fault **A** Timer<br>• P544 Pump Fault **B** Timer |

## P543 Pump Fault A Timer

*Indicates the length of time the pump fault A indicator must be asserted before the SITRANS LUC500 will flag a pump fault.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0000 to 9999 seconds |
| | Preset: 0 seconds |
| Related | • P548 Pump Fault **A** Reset Mode |

## P544 Pump Fault B Timer

*Indicates the length of time the pump fault B indicator must be asserted before the SITRANS LUC500 will flag a pump fault.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0000 to 9999 |
| | Preset: 0 (sec) |
| Related | • P549 Pump Fault **B** Reset Mode |

## P545 Pump Fault C Timer

*Indicates the length of time the pump fault C indicator must be asserted before the SITRANS LUC500 will flag a pump fault.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0000 to 9999 |
| | Preset: 0 (sec) |
| Related | • P550 Pump Fault **C** Reset Mode |

# P546 Pump Running Fault Reset Mode

*Reset method for pump running fault.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | standard operation (fault is latched) |
| | 1 | | Reset pump at power-up. The pump will be made available if the fault has cleared |
| Related | • P551 Pump Auto-Reset Limit<br>• P554 Pump Auto-Reset Count | | |

# P548 Pump Fault A Reset Mode

*Reset method for pump fault A.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | standard operation (fault is latched) |
| | 1 | | Reset pump at power-up. The pump will be made available if the fault has cleared. |
| | 2 | | Reset when fault indicator clears |
| | 3 | | Combines actions of 1 and 2 |
| Related | • P551 Pump Auto-Reset Limit<br>• P554 Pump Auto-Reset Count | | |

# P549 Pump Fault B Reset Mode

*Reset method for pump fault B.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | standard operation (fault is latched) |
| | 1 | | Reset pump at power-up. The pump will be made available if the fault has cleared. |
| | 2 | | Reset when fault indicator clears |
| | 3 | | Combines actions of 1 and 2 |
| Related | • P551 Pump Auto-Reset Limit<br>• P554 Pump Auto-Reset Count | | |

# P550 Pump Fault C Reset Mode

*Reset method for pump fault C.*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | standard operation (fault is latched) |
| | 1 | | Reset pump at power-up. The pump will be made available if the fault has cleared. |
| | 2 | | Reset when fault indicator clears |
| | 3 | | Combines actions of 1 and 2 |
| Related | • P551 Pump Auto-Reset Limit<br>• P554 Pump Auto-Reset Count | | |

# P551 Pump Auto-Reset Limit

*Sets the number of automatic resets allowed for pump. This function only applies to **Reset when fault clears**. If zero, then number of automatic resets is not limited.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 255 |
| Related | • P554 Pump Auto-Reset Count |

The number of auto-resets performed by the SITRANS LUC500 can be limited by using Pump Auto-Reset Limit (P551). The number of Auto-resets is recorded in Pump Auto-Reset Count (P554). After the limit is reached, a manual reset of the pump is required. As well, Pump Auto-Reset Count (P554) **must** be reset to zero (0) or the pump will not auto-reset.

## P554 Pump Auto-Reset Count

*Records the number of automatic resets. Set value to zero to reset.*

| | |
|---|---|
| Primary Index | relay |
| Values | Range: 0 to 255 (view only) |
| Related | • P551 Pump Auto-Reset Limit |

## P558 Pump Start Discrete Input

*Designates the discrete input to be used to force a pump to turn ON. (This will override settings in P112.)*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | off (no manual override) |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |

P558 and P559 can be set to use discrete inputs to override pump control settings in P111, P112, and P113. See *Setting Pump with Float Backup* on page 92 for an example using floats as discrete inputs.

## P559 Pump Stop Discrete Input

*Designates the discrete input to be used to force a pump to turn OFF. (This will override settings in P113.)*

| | | | |
|---|---|---|---|
| Primary Index | relay | | |
| Values | 0 | * | off (no manual override) |
| | 1-8 | | discrete input (base unit) |
| | 9-16 | | discrete input (with optional input board) |

# OCM (P600 to P621)

If the SITRANS LUC500 is used to monitor open channel flow, alter the following parameters as required and run a calibration as described in P621.

**Note:** See *Open Channel Monitoring (OCM)* on page 102 for application examples involving common weirs and flumes.

The SITRANS LUC500 measures head as referenced to Empty (P006) or OCM Zero Offset (P605), when Operation is set for OCM (P001 = 6). Flowrate, based on head (at the **point of measure** specified by the Primary Measuring Device fabricator) is also calculated and displayed on the LCD.

Some Primary Measuring Devices require a longer Range Extension (P801) to avoid entering the LOE failure state if the water level falls below the zero point of the Primary Measuring Device. See *P801 Range Extension* on page 276 for more information.

# P600 Primary Measuring Device

*The type of primary measuring device (PMD) used.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | * | off (no calculation) |
| | 1 | | Exponential (see P601) |
| | 2 | | Palmer-Bowlus Flume (see P602) |
| | 3 | | H-Flume (see P602) |
| | 4 | | Universal Linear Flow Calculation (see P610, P611) |
| | 5 | | Universal Curved Flow Calculation (see P610, P611) |
| | 6 | | BS-3680/ISO 4359 Rectangular Flume (see P602) |
| | 7 | | BS-3680/ISO 1438/1 Thin Plate V-Notch Weir (see P602) |
| | 8 | | Round Pipe with velocity sensor |
| | 9 | | Rectangular Channel with velocity sensor |
| | 10 | | Universal Linear Area Calculation, Area x Velocity (P610, 611) |
| | 11 | | Universal Cubic Area Calculation, Area x Velocity (P610, 611) |
| Alters | • P601 Flow Exponent<br>• P602 Primary Measuring Device Dimensions<br>• P608 Flowrate Units | | |
| Altered By | • P001 Operation | | |
| Related | • P603 Maximum Head<br>• P604 Maximum Flow<br>• P605 Zero Head<br>• P609 Maximum Area<br>• P610 Head Breakpoints<br>• P611 Breakpoint<br>• P612 OCM Velocity Source | | |

The SITRANS LUC500 is pre-programmed for common PMD flow calculations. If your PMD is not listed, select the appropriate Universal Flow Calculation.

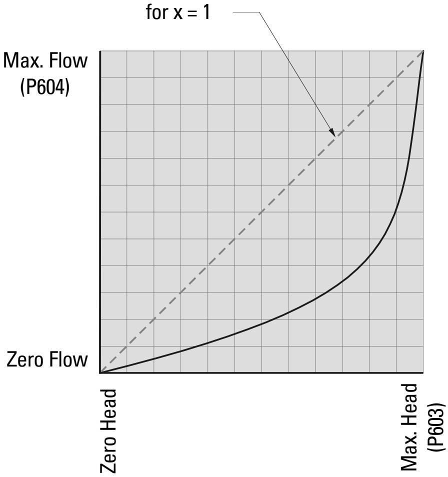
Associated parameters Max Head (P603), Max Flow (P604), and Min Head (P605) may be scroll accessed. If Operation is not set for OCM (P001 = 6), this value is preset to 0. If Operation is set for OCM, it is preset to 1.

# P601 Flow Exponent

*The Exponent for the flow calculation formula.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| | Preset: 1.55 | |
| Altered By | • P600 Primary Measuring Device | |
| Related | • P603 Maximum Head<br>• P605 Maximum Flow<br>• P605 Zero Head | |

Use this parameter if the Primary Measuring Device (P600) is set to 1 (exponential). It creates an exponential curve with end points set by Max Head (P603) and Zero Head (P604) and with the curve based on the specified exponent.




**Exponents**

The exponential equation is:

$$Q = KH^{P601}$$

Where:

- Q = flow
- K = internal constant
- H = head

Use the exponent specified by the PMD manufacturer, if available, or the sample value given below.

## Example Exponents

| PMD Type | Exponent (sample only) |
|---|---|
| Suppressed Rectangular Weir | 1.50 |
| Cipolletti Weir | 1.50 |
| Venturi Flume | 1.50 |
| Parshall Flume | 1.22 to 1.607 |
| Leopold Lagco | 1.547 |
| V-Notch Weir | 2.50 |

# P602 Primary Measuring Device Dimensions

*The dimensions of the Primary Measuring Device (PMD).Use this parameter only if the Primary Measuring Device is directly supported (P600=2,3,6,7).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Secondary Index | Dimension | |
| Index Values for Supported PMDs | ISO 1438/1 | |
| | 1 | Notch Angle |
| | 2 | Discharge Coefficient |
| | ISO 4359 | |
| | 1 | Approach width |
| | 2 | Throat width |
| | 3 | Hump Height |
| | 4 | Throat Length |
| | 5 | Velocity coefficient |
| | 6 | Discharge coefficient |
| | Palmer Bowlus | |
| | 1 | Flume width |
| | H Flume | |
| | 1 | Flume height |
| Altered By | • P600 Primary Measuring Device | |

The dimensions required for each PMD vary. See the examples beginning on page 108 for full descriptions of the required values.

# P603 Maximum Head

*The level value above Zero Head (P605) associated with Maximum Flow, in Units (P005).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| | Preset: Span (P007) value | |
| Altered By | • P005 Units<br>• P600 Primary Measuring Device | |
| Related | • P604 Maximum Flow<br>• P605 Zero Head | |

This represents the highest head level supported by the PMD and works in conjunction with Maximum Flow (P604) to define the highest point in the exponential curve. Use it when the Primary Measuring Device (PMD) requires a maximum head and flow reference point. This would include Exponential, Palmer Bowlus Flume, H Flume, and Universal breakpoints. Enter the Maximum Head before defining head breakpoints in P610.

# P604 Maximum Flow

*The maximum flowrate associated with Maximum Head (P603).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| | Preset: 1000 | |
| Alters | • P316 Overflow Event Volume | |
| Altered By | • P600 Primary Measuring Device | |
| Related | • P603 Maximum Head<br>• P606 Time Units<br>• P925 Flow Measurement | |

This represents the flow at the highest head level supported by the PMD and works in conjunction with Maximum Head (P603) to define the highest point in the exponential curve. Use it when the Primary Measuring Device (PMD) requires a maximum head and flow reference point. This would include Exponential, Palmer Bowlus Flume, H Flume, and Universal breakpoints. Enter the Maximum Flow before defining flow breakpoints in P611.

Also use this parameter with Time Units (P606) to define the flowrate units. The limitation of four digits is for the LCD only, and the flowrate value is available with greater precision through communications.

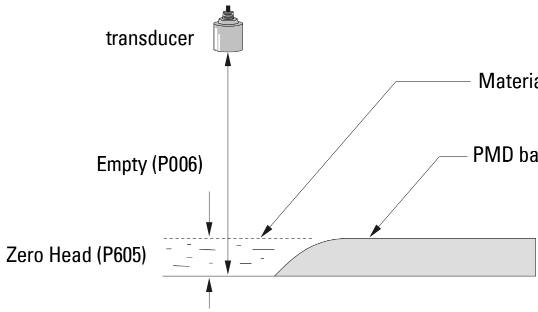
e.g. If flowrate is to be displayed in millions of gallons / day, and the maximum flowrate is 376,500,000 gallons / day, enter **376.5** for Maximum Flow (P604) and **4** for Time Units (P606).

# P605 Zero Head

*The distance above Empty (P006) in Units (P005) representing zero head (and zero flow).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| | Preset: 0.000 | |
| Altered By | • P005 Units<br>• P007 Span | |
| Related | • P006 Empty<br>• P801 Range Extension<br>• P926 Head Measurement | |

This feature can be used for most weirs and some flumes (e.g. Palmer Bowlus) where the zero reference is at a higher elevation than the channel bottom.




# P606 Time Units

*Determines the units used to display current flow and logging flow values.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 1 | | seconds |
| | 2 | | minutes |
| | 3 | | hours |
| | 4 | * | days |
| Alters | • P316 Overflow Event Volume | | |
| Altered By | • P608 Flowrate Units | | |

This is used when the Primary Measuring Device is **Ratiometric** (P608=0).

e.g. If flowrate is to be displayed in millions of gallons / day, and the maximum flowrate is 376,500,000 gallons / day, enter **376.5** for Maximum Flow (P604) and **4** for Time Units (P606).

# P608 Flowrate Units

*The volume units used to display total flow.*

Use this parameter only if the primary measuring device (PMD) supports absolute calculations (P600=6, 7). Leave it at **0** for all other P600 values.

| | | | | |
|---|---|---|---|---|
| Primary Index | **Single Point Model** | | | **Dual Point Model** |
| | global | | | transducer |
| Values | Ratiometric (P600=all) | | | |
| | 0 | * | Ratiometric calculation (units defined by P606) | |
| | Absolute (P600=6,7 only) | | | |
| | 1 | | litres / second | |
| | 2 | | cubic metres / hour | |
| | 3 | | cubic metres / day | |
| | 4 | | cubic feet / second | |
| | 5 | | gallons / minute – Imperial | |
| | 6 | | million gallons / day – Imperial | |
| | 7 | | gallons / minute – U.S. | |
| | 8 | | million gallons / day – U.S. | |
| Alters | • P316 Overflow Event Volume<br>• P606 Time Units | | | |
| Altered By | • P600 Primary Measuring Device | | | |
| Related | • P608 Flowrate Units | | | |

For absolute PMDs (P600=6,7) volume units can be specified using this parameter. If needed, absolute PMDs can still use ratiometric (P608=0) to accommodate other units.

# P609 Maximum Area

*The maximum area associated with Maximum Head (P603). Used when P600 = 10 or 11, Universal Area.*

| | | |
|---|---|---|
| Primary Index | **Single Point Model** | **Dual Point Model** |
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P611 Breakpoint Flowrates | |

This represents the area at the highest head level supported by the PMD and works in conjunction with Maximum Head (P603) to define the highest point in the exponential curve. Use it when the Primary Measuring Device (PMD) requires a maximum head and area reference point (P600 PMD = 10 or 11 Universal Area). Enter the area before defining area breakpoints in P611.

Maximum Area can be used with a known maximum velocity (P254) to calculate P604 Maximum Flow in a regular channel.

# P610 Head Breakpoints

*The head breakpoints for which flowrate is known.*

| | | |
|---|---|---|
| Primary Index | **Single Point Model** | **Dual Point Model** |
| | global | transducer |
| Secondary Index | Breakpoint | |
| Values | Range: 0.000 to 9999 | |
| Related | • P611 Breakpoint Flowrates | |

The values in the Span for which flowrates are known. See *Universal Calculation Support* on page 111 for how to specify universal flows.

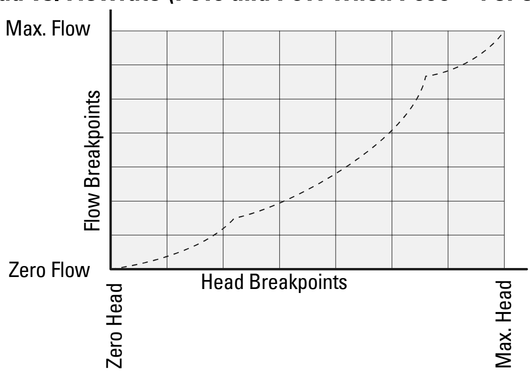
# P611 Flow or Area Breakpoints

*The flowrate or area corresponding to each Head Breakpoint entered.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Secondary Index | Breakpoint | |
| Values | Range: 0.000 to 9999 | |
| Related | • P610 Head Breakpoints | |

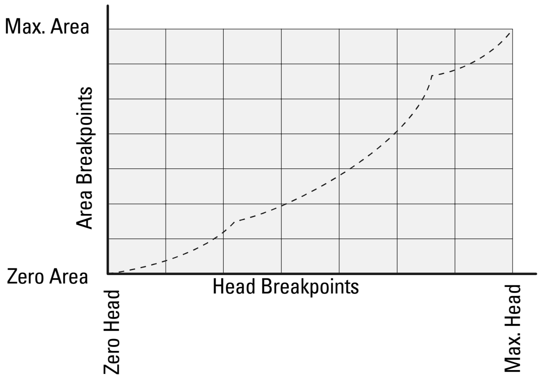
These are the flowrates for the related breakpoints. See *Universal Calculation Support* on page 111 for how to specify universal flows.

### Head vs. Flowrate (P610 and P611 when P600 = 4 or 5, Universal Flow)




These are the areas for the related breakpoints.

### Head vs. Area (P610 and P611 when P600 = 10 or 11, Universal Area)




# P612 OCM Velocity Source

*Specifies the mA input for use in velocity reading.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0* to 5 (depending on installed hardware) | |
| Related | • mA Input (P250 to P254)<br>• P254 Scaled mA Input Value | |

# P620 Low Flow Cutoff

*Eliminates totalizer activity for flows at or below the cutoff value.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset = 5.000 % or equivalent units | |
| Altered By | • P005 Units | |
| Related | • P603 Maximum Head | |

Use this to enter the minimum head in units (P005) or as a percent of span.

**Note:** Flow depends on head and velocity. So, if head is relatively low, but velocity is high, flow levels could be high.

# P621 Auto Zero Head

*Calibrates Zero Head (P605) based on actual head measurements.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| Related | • P006 Empty<br>• P0062 Offset Reading<br>• P605 Zero Head<br>• P664 Temperature | |

Use this parameter when the reported head is consistently high or low by a fixed amount.

**Before using this feature, verify the following parameters are correct:**

- Empty (P006)
- Temperature (P664)
- Offset Reading (P062=0)
- Zero Head Offset (P605)

**Procedure, with HEAD steady ...**

1. Press to display the calculated head
2. Repeat step 1 at least 5 times to verify repeatability
3. Measure the actual head (e.g. with a tape measure or solid rule)
4. Enter the actual head value

The deviation between the entered Empty (P006) value and the calibrated Empty value, is stored in Offset Correction (P652). Alternatively, the Empty parameter (P006) can be corrected directly.

# Pumped Volume Totalizer (P622 to P623)



If the 8 digit totalizer display, or a remote totalizer contact closure is desired, alter the following parameters.

## P622 Inflow / Discharge Adjust

*The method used to calculate the volume pumped, for **pumped total**: Operation (P001 = 7).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | 1 = inflow * / pump cycle<br>When the pump is off, the SITRANS LUC500 estimates the volume of inflow by recording the rate at which the liquid level changes. When the pump is operating, the estimated inflow volume is added to the pumped volume total. When the pump stops, the pumped volume of the previous pump cycle is added to the total volume pumped in the totalizer. | |
| | 2 = inflow * ignored<br>Inflow is assumed to be 0 while pumps are running. | |
| | 3 = inflow * / rate (preset)<br>Volume pumped is adjusted for inflow. Inflow rate is estimated by assuming that the rate calculated (P708) just prior to the start of the pump cycle remained constant during the pump cycle. Inflow rate is averaged using rate filter (P704), rate update time (P705) and rate update distance (P706) to control how the average rate is calculated. | |
| Related | • P001 Operation<br>• P704 Rate Filter<br>• P705 Rate Update Time<br>• P706 Rate Update Distance<br>• P708 Volume Rate Display | |

* or discharge

## P623 Pump Total Method

*This parameter determines the method used for updating the pumped volume totalizer.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | 1 = Volume readings at Start and End<br>Volume pumped is calculated from the volume readings at the start and end of the pump cycle. The result is compensated for estimated inflow which is added to the total volume change while pumps are running. Inflow rate is estimated as selected by the inflow / discharge adjust (P622). | |
| | 2 = Pump Capacity and Running Time (preset)<br>Volume pumped is calculated from the Pump Capacity (P182) for each pump, and the running time of each pump. Pump Capacity is recalculated on each pump cycle, based on the rate of change of level or volume before and after each pump starts. Accuracy of the totalizer when using this selection is entirely dependent on the accuracy of the rate calculation, so the user must ensure that appropriate settings are entered for Pump Capacity Time (P181) and Pump Start Delay (P132). | |
| Related | • P132 Pump Start Delay<br>• P181 Pump Capacity Time<br>• P182 Pump Measured Capacity<br>• P622 inflow / Discharge Adjust | |

# Totalizer (P630 to P645)

## P630 LCD Totalized Multiplier

*Use this feature if the LCD Total increments by too large (or too small) an amount.*

| Primary Index | **Single Point Model** | | **Dual Point Model** |
|---|---|---|---|
| | global | | transducer |
| Values | -3 | | .001 |
| | -2 | | .01 |
| | -1 | | .1 |
| | 0 | * | 1 |
| | 1 | | 10 |
| | 2 | | 100 |
| | 3 | | 1000 |
| | 4 | | 10,000 |
| | 5 | | 100,000 |
| | 6 | | 1,000,000 |
| | 7 | | 10,000,000 |
| Related | • LCD Totalizer (P322 and P323) | | |

Enter the factor (powers of 10 only) by which actual volume is divided, prior to display on the LCD. Use a value such that the eight-digit totalizer does not roll over between readings.

e.g. for an LCD Total display in 1000s of volume units, enter 3.

**Note:** If you change the value of P630, it will not update the totalizer display using the new factor until the next reading occurs.

## P633 LCD Totalized Decimal Position

*Enter the maximum number of decimal places to be displayed.*

| Primary Index | **Single Point Model** | | **Dual Point Model** |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | | no digits after the decimal point |
| | 1 | | 1 digit after the decimal point |
| | 2 | * | 2 digits after the decimal point |
| | 3 | | 3 digits after the decimal point |
| Related | • LCD Totalizer (P322 and P323) | | |

**Note:** Set the decimal position during initial commissioning of the SITRANS LUC500 SITRANS LUC500. If the position is changed later, the totalizer data in P322 and P323 will be incorrect and must be reset according to the new decimal value.

In the RUN mode, the number of decimal places displayed is not automatically adjusted. When the LCD Total value is so large as to exceed display capabilities, the total rolls over to **0** and continues incrementing.

# P640 Remote Totalized Multiplier

*Use this feature if the remote totalizer (device connected to the relay set for **totalizer operation** Relay Function, P111 = 40), updates too slowly or rapidly.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | -3 | | .001 |
| | -2 | | .01 |
| | -1 | | .1 |
| | 0 | * | 1 |
| | 1 | | 10 |
| | 2 | | 100 |
| | 3 | | 1000 |
| | 4 | | 10,000 |
| | 5 | | 100,000 |
| | 6 | | 1,000,000 |
| | 7 | | 10,000,000 |
| Related | • P001 Operation<br>• P111 Relay Control Function<br>• P114 Relay DURATION Setpoint<br>• P115 Relay INTERVAL Setpoint<br>• P645 Relay Duration | | |

This parameter is relevant if Operation is set to OCM or Pumped Volume (P001 = 6 or 7).

The relays on the SITRANS LUC500 have a maximum frequency of 2.5 Hz.

Enter the factor (powers of 10 only) by which actual volume is divided, prior to Remote Totalizer count increment.

e.g. for a Remote Totalizer update by 1000s of volume units, enter 3.

# P641 Flow Sampler Mantissa

*Use this feature in conjunction with Flow Sampler Exponent (P642) to establish the number of flow units required to increment the Flow Sampler (device connected to the SITRANS LUC500 relay set for the **flow sampler operation** Relay Function, P111 = 41).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.001 to 9999 | |
| | Preset = 1.000 | |
| Related | • P001 Operation<br>• P111 Relay Control Function<br>• OCM (P600 to P621)<br>• P642 Flow Sampler Exponent | |

This parameter is relevant only if Operation is set to OCM (P001 = 6).

### Enter the mantissa (Y) for the exponent (Z) in the formula...

Flow Sampler Increment = Y x $10^Z$ Flow units.

e.g.To count once every 4310 (4.31 x $10^3$) flow units, set P641 to 4.31 and P642 to 3.

## P642 Flow Sampler Exponent

*Use this feature in conjunction with Flow Sampler Mantissa (P641) to establish the number of flow units required to increment the Flow Sampler (device connected to the SITRANS LUC500 relay set for the **flow sampler operation** Relay Function, P111 = 41).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: -3 to +7 (integers only) | |
| | Preset = 0 | |
| Related | • P001 Operation<br>• P111 Relay Control Function<br>• OCM (P600 to P621)<br>• P641 Flow Sampler Mantissa | |

This parameter is relevant only if Operation is set to OCM (P001 = 6).

**Enter the exponent (Z) for the mantissa (Y) in the formula:**

Flow Sampler Increment = Y x $10^Z$ Flow units.

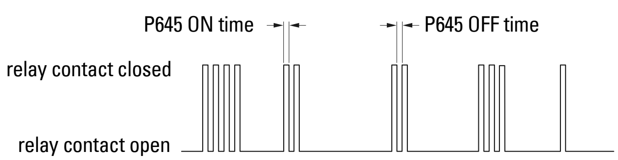
## P645 Relay Duration

*Use this feature (if desired) to adjust the minimum contact closure duration of a relay set as a totalizer, flow sampler, time [control], or aeration (P111 = 40, 41, 60 or 62).*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.1 to 1024 |
| | Preset = 0.2 (sec) |
| Related | • P111 Relay Control Function |

Enter the minimum contact closure duration (in seconds) required by the device connected.

For the flow sampler function this value is used for both the ON time of the relay and the OFF time between contacts.




# Range Calibration (P650 to P654)

**There are two types of calibration possible:**

**Offset:** Adjusts the measurements by a fixed amount.

**Sound Velocity:** Adjusts the speed of sound and changes the measurement calculations.

Do Offset calibration at any steady level unless a Sound Velocity calibration is also done. If both calibrations are done then do Offset at a known high level and Sound Velocity at a known low level.

# P650 Offset Calibration

*Calibrates Empty (P006) if the reported level is consistently high or low by a fixed amount.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| Related | • P006 Empty<br>• P062 Offset Reading<br>• P605 Zero Head<br>• P652 Offset Correction<br>• P664 Temperature | |

**Before using this feature, verify the following parameters are correct:**

- Empty (P006)
- Temperature (P664)
- Offset Reading (P062)
- Zero Head Offset (P605)

**With the level steady…**

1. Press to display the calculated reading
2. Repeat step 1 at least 5 times to verify repeatability
3. Measure the actual reading (e.g. with a tape measure)
4. Enter the actual value

The deviation between the entered Empty (P006) value and the calibrated Empty value, is stored in Offset Correction (P652).

# P651 Sound Velocity Calibration

*Changes the speed of sound constant.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| Related | • P653 Velocity<br>• P654 Velocity at +20 °C | |

**Use this feature if:**

- The acoustic beam atmosphere is other than air
- The acoustic beam atmosphere temperature is unknown
- The reading accuracy is acceptable at higher material levels only

For best results do this calibration with the level at a known value near empty.

**With the level steady at some low value...**

1. Allow sufficient time for the vapor concentration to stabilize
2. Press to display the calculated reading
3. Repeat step 2 at least 5 times to verify repeatability
4. Measure the actual reading (e.g. with a tape measure)
5. Enter the actual value

(Velocity parameters P653 and P654 are adjusted accordingly).

Repeat this procedure if the atmosphere type, concentration, or temperature varies from that present when the last sound velocity calibration was performed.

**Note:** In gasses other than air the temperature variation may not correspond with the speed of sound variation. In these cases turn off the temperature sensor and use a fixed temperature.

# P652 Offset Correction

*The value altered when an Offset Calibration is performed.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 999.0 | |
| Related | • P650 Offset Calibration | |

Alternatively, if the amount of Offset Correction required is known, enter the amount to be added to the reading before display.

# P653 Velocity

*The value adjusted based on the Sound Velocity at +20 °C (P654) vs. Temperature (P664) characteristics of air.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 50.01 to 2001 m/s (164.1 to 6563 ft/s) | |
| Related | • P651 Sound Velocity Calibration<br>• P654 Velocity at +20 °C | |

Alternatively, enter the current sound velocity (if known), or perform a Sound Velocity Calibration (P651). The units used are m/s if P005 = 1, 2, or 3 (ft/s if P005 = 4 or 5).

# P654 Velocity at +20 °C

*This value is used to automatically calculate Sound Velocity (P653).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 50.01 to 2001 m/s (164.1 to 6563 ft/s) | |
| Related | • P005 Units<br>• P651 Sound Velocity Calibration<br>• P653 Velocity | |

After performing a Sound Velocity Calibration, check this value to verify the acoustic beam atmosphere is air (344.1 m/s or 1129 ft/s).

Alternatively, if the acoustic beam atmosphere sound velocity at +20 °C (+68 °F) is known, and the sound velocity vs. temperature characteristics are similar to that of air, enter the sound velocity.

The units used are m/s if P005 = 1, 2, or 3 (or ft/s if P005 = 4 or 5).

# Temperature Compensation (P660 to P664)



## P660 Temp Source

*Source of the temperature reading used to adjust the speed of sound.*

| Primary Index | transducer | | |
|---|---|---|---|
| Values | 1 | * | AUTO |
| | 2 | | Temp Fixed |
| | 3 | | Ultrasonic/Temperature Transducer |
| | 4 | | TS-3 Temperature Sensor |
| | 5 | | Average (TS-3 and transducer) |
| Alters | • P664 Temperature | | |
| Related | • P651 Sound Velocity Calibration<br>• P653 Velocity<br>• P654 Velocity at +20 °C<br>• P661 Temp Fixed | | |

The SITRANS LUC500 uses the TS-3 temperature sensor assigned to the transducer unless one is not connected, in which case the ultrasonic/temperature transducer is used. If the transducer does not have an internal temperature sensor, the Temp Fixed (P661) value is used.

If the acoustic beam atmosphere temperature varies with distance from the transducer, connect a TS-3 Temperature Sensor and ultrasonic / temperature transducers, and select **Average**.

**Note:** In gasses other than air the temperature variation may not correspond with the speed of sound variation. In these cases turn off the temperature sensor and use a fixed temperature.

## P661 Temp Fixed

*Use this feature if a temperature sensing device is not used.*

| Primary Index | transducer |
|---|---|
| Values | Range: -199 to 199 (preset = +20 °C) |
| Related | • P651 Sound Velocity Calibration<br>• P653 Velocity<br>• P654 Velocity at +20 °C<br>• P660 Temp Source |

Enter the temperature (in °C) of the atmosphere within the transducer acoustic beam. If the temperature varies with distance from the transducer, enter the average temperature.

## P663 Temperature Transducer Allocation

*This feature may only be used for **Differential**, **Average**, or **Sum** Operation (P001 = 4 , 5, or 10).*

| Primary Index | transducer | | |
|---|---|---|---|
| Values | 1 | * | Transducer # 1 |
| | 2 | | Transducer # 2 |
| | 1:2 | | Transducer # 1 and 2 average |
| Related | • P651 Sound Velocity Calibration<br>• P653 Velocity<br>• P654 Velocity at +20 °C | | |

As preset, the temperature measurements of Ultrasonic / Temperature Transducer # 1 and 2 are allocated to Point Number 1 and 2 respectively.

Use this feature if the temperature measurement from both transducers should be identical, but one is located close to a radiant heat source. Allocate the temperature measurement of the other transducer to both transducer Point Numbers. Enter the Transducer Number whose temperature measurement will be used for the distance calculation of the Point Number displayed. When both transducers are allocated to a Point Number, the temperature measurements from each are averaged.

## P664 Temperature

*View the transducer temperature in °C.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: -50 to 150 (view only) |
| Altered By | • P660 Temp Source |
| Related | • P651 Sound Velocity Calibration<br>• P653 Velocity<br>• P654 Velocity at +20 °C<br>• P661 Temp Fixed |

This value is displayed when 6 is pressed in RUN mode (see *Operating the SITRANS LUC500* on page 34).

If Temp Source (P660) is set to any value other than Fixed Temp, the value displayed is the temperature measured. If Temp Source is set to Fixed Temp, the P661 value is displayed.

# Rate (P700 to P708)

These parameters determine how material level changes are reported.

## P700 Max Fill Rate

*Adjusts the SITRANS LUC500 response to increases in the actual material level (or advance to a higher Failsafe Material Level, P071).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P005 Units<br>• P007 Span<br>• P071 Failsafe Material Level | |

Enter a value slightly greater than the maximum vessel filling rate. This value, in Units (P005) or % of Span (P007) per minute, is automatically altered when Maximum Process Speed (P003) is altered. Any fill rate above this value will trigger any alarms set to **rate**.

| P003 Value | Meters / Minute |
|---|---|
| 1 | 0.1 |
| 2 | 1 |
| 3 | 10 |

# P701 Max Empty Rate

*Adjusts the SITRANS LUC500 response to decreases in the actual material level (or advance to a lower Failsafe Material Level, P071).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P005 Units<br>• P007 Span<br>• P071 Failsafe Material Level | |

Enter a value slightly greater than the maximum vessel emptying rate. This value, in Units (P005) or % of Span (P007) per minute, is automatically altered when Maximum Process Speed (P003) is altered. Any empty rate above this value will trigger any alarms set to **rate**.

| P003 Value | Meters / Minute |
|---|---|
| 1 | 0.1 |
| 2 | 1 |
| 3 | 10 |

# P702 Filling Indicator

*The fill rate required to activate the LCD Filling indicator ( ).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P005 Units<br>• P007 Span<br>• P700 Max Fill Rate | |

This value (in Units (P005) or % of Span (P007) per minute) is automatically set to 1/10 of the Max Fill Rate (P700).

# P703 Emptying Indicator

*The empty rate required to activate the LCD Emptying indicator ( ).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P005 Units<br>• P007 Span<br>• P701 Max Empty Rate | |

This value (in Units (P005) or % of Span (P007) per minute) is automatically set to 1/10 of the Max Empty Rate (P701).

# P704 Rate Filter

*Damps Rate Value (P707) fluctuations.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | | rate display not required |
| | Filtered Output | | |
| | 1 | | continuously filtered and updated |
| | Interval Output | | |
| | 2 | | 1 minute or 50 mm (2 in) |
| | 3 | | 5 minutes or 100 mm (3.9 in) |
| | 4 | | 10 minutes or 300 mm (11.8 in) |
| | 5 | | 10 minutes or 1000 mm (39.4 in) |
| Alters | • P707 Rate Value | | |
| Altered by | • P003 Maximum Process Speed | | |
| Related | • P705 Rate Update Time<br>• P706 Rate Update Distance | | |

Enter the time or distance interval over which the Rate Value is to be calculated before the display updates.

This is automatically altered along with Maximum Process Speed (P003) is. See the description of *Maximum Process Speed* on page 300.

This value automatically alters the Rate Update Time (P705) and / or Rate Update Distance (P706). Alternatively, these parameter values may be altered independently.

# P705 Rate Update Time

*The time period (in seconds) over which the material level rate of change is averaged before Rate Value update.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P707 Rate Value | |

# P706 Rate Update Distance

*The material level change (in metres) to initiate a Rate Value update.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P707 Rate Value | |

# P707 Rate Value

*The rate of material level change (in Units (P005) or % of Span (P007) per minute).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 (view only) | |
| Altered By | • P704 Rate Filter | |
| Related | • P005 Units<br>• P007 Span | |

A negative rate indicates the vessel is emptying.

This is the value displayed when [key] is pressed in RUN mode. See *Operating the SITRANS LUC500* on page 34.

## P708 Volume Rate Display

*The rate of change of volume in **percent of maximum volume** per minute.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: -999 to 9999 (view only) | |
| Related | • P622 Inflow / Discharge Adjust<br>• P623 Pump Total Method | |

This value is used internally to calculate inflow in pumped volume applications (P622=3 and P623=1). Press [key] to toggle between percent and volume.

# Measurement Verification (P710 to P713)

## P710 Fuzz Filter

*Use this to stabilize the reported level, due to level fluctuations (such as a rippling or splashing liquid surface), within the Echo Lock Window (P713).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0 to 100 (0 = off) | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P007 Span<br>• P713 Echo Lock Window | |

This value (in % of Span, P007) is automatically altered when Maximum Process Speed (P003) is altered. The higher the value entered, the greater the fluctuation stabilized.

## P711 Echo Lock

*Use this feature to select the measurement verification process.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | | off |
| | 1 | | maximum verification |
| | 2 | * | material agitator |
| | 3 | | total lock |
| Related | • P700 Max Fill Rate<br>• P701 Max Empty Rate<br>• P712 Echo Lock Sampling<br>• P713 Echo Lock Window<br>• P820 Algorithm | | |

If a material agitator (mixer) is used in the vessel monitored, set Echo Lock for **maximum verification** or **material agitator**, to avoid agitator blade detection. Ensure the agitator is always ON while the SITRANS LUC500 is monitoring the vessel, to avoid stationary blade detection.

When set for **max verification** or **material agitator**, a new measurement outside of the Echo Lock Window (P713) must meet the sampling criterion (P712).

For **total lock**, Echo Lock Window (P713) is preset to zero (**0**). The SITRANS LUC500 continuously searches for the best echo according to the algorithm chosen (P820). If the selected echo is within the window, the window is then centered about the echo. If not, the window widens with each successive shot until the selected echo is within the window. The window then returns to its normal width.

When Echo Lock is **OFF**, the SITRANS LUC500 responds immediately to a new measurement as restricted by the Max Fill / Empty Rate (P700 / P701), however measurement reliability is affected.

# P712 Echo Lock Sampling

*The sampling criterion sets the number of consecutive echoes appearing above or below the echo currently locked onto, that must occur before the measurements are validated as the new reading (for Echo Lock P711 values: 1 or 2).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 1:1 to 99:99 | |
| | Format: x:y | |
| | x = the number of “above” echoes | |
| | y = the number of “below” echoes | |
| Related | • P711 Echo Lock | |

| P711 value | P712 preset value |
|---|---|
| 1, max verification | 5:5 |
| 2, material agitator | 5:2 |

e.g.: P711 = 2, material agitator P712 = 5:2

This means that a new reading will not be validated unless 5 consecutive measurements higher or 2 consecutive measurements lower than the current reading occurs.

Resetting P711 returns P712 to the respective preset values.

# P713 Echo Lock Window

*Adjusts the size of the Echo Lock Window.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 0.000 | |
| Altered by | • P003 Maximum Process Speed | |
| Related | • P005 Units<br>• P711 Echo Lock | |

The Echo Lock Window is a **distance window** (units P005) centred on the echo and used to derive the Reading. When a new measurement is in the window, it is re-centred and the new Reading calculated. Otherwise, the new measurement is verified by Echo Lock (P711) before the reading is updated.

When **0** is entered the window is automatically calculated after each measurement. For slower P003 Maximum Process Speed values the window is narrow, for faster P003 values the window becomes wider.

# Transducer Scanning (P726 to P728)

## P726 Level System Sync

*Enables the System Sync on the terminal block.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | | not required |
| | 1 | * | synchronize level monitors |

Use this if another level measurement system is mounted nearby, and they are wired together on the Sync terminal.

## P727 Scan Delay

*The delay, in seconds, between measurements from transducer points.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.000 to 9999 |
| | Preset: 5.0 |
| Altered by | • P003 Maximum Process Speed |
| Related | • P001 Operation |

This feature may only be used for Differential, Average, or Sum Operation (P001 = 4, 5, or 10), to adjust the delay before the next point is scanned. Enter the amount of delay in seconds. This value is automatically altered when Maximum Process Speed (P003) is altered.

## P728 Shot Delay

*The delay, in seconds, between transducer shots.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.1 to 4.0 |
| | Preset: 0.5 |

Use this if transient acoustic noise within the vessel is causing measurement difficulties due to echoes from one shot being received on the next.

## P729 Scan Time

*View the elapsed time (in seconds) since the point displayed was last scanned.*

| | |
|---|---|
| Primary Index | level point |
| Values | Range: 0.000 to 9999 (view only) |
| Related | • P001 Operation |

This may be viewed as an Auxiliary Reading in the RUN mode, and is useful when Differential, Average, or Sum (P001 = 4, 5, or 10) is selected.

# Display (P730 to P739)

## P730 Auxiliary Reading

*Use this feature to display operator selected Auxiliary Readings temporarily or indefinitely (as desired).*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | Range: 000 to 999 | |
| | Display: OFF, HOLd | |

Select **OFF** to display Auxiliary Readings temporarily. Select **HOLd** to display Auxiliary Readings until another Auxiliary Reading is selected or programming mode is entered. See *Hand Programmer* on page 42 for RUN mode auxiliary readings.

**To select the Auxiliary Reading operation desired...**

1. Press [▲%] to display the Auxiliary Function symbol.
2. Press [▲] or [▼] to access the **OFF** or **HOLd** option desired.
3. Press [↵]

If desired, enter the Parameter Number to default in the Auxiliary Reading display. That value will show in the auxiliary reading area by default. Other values are available but will reset to the parameter defined here.

## P731 Auxiliary Reading Key

*Enter the Parameter Number whose value is to be displayed in the Auxiliary Reading field when...*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | Range: 000 to 999 | |
| | Preset: Material Reading, P921 | |

[P] is pressed in the RUN mode. See *Hand Programmer* on page 42 for RUN mode auxiliary readings.

## P732 Display Delay

*Adjusts the Point Number display scroll speed.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0.5 to 10 |
| | Preset: 1.5 seconds |
| Related | • P001 Operation<br>• P737 Primary Reading |

Use this feature when Differential, Average, or Sum (P001 = 4, 5, or 10) is selected, to adjust the delay before the display advances to the next Point Number. Display scrolling is independent from transducer scanning.

# P733 Scroll Access

*Use this feature to select the parameter scroll access option desired.*

| | | | | |
|---|---|---|---|---|
| Primary Index | global | | | |
| Values | 0 | | off | to scroll to all parameters (P001 to P999) |
| | 1 | * | smart | for Quick Start, altered, and tagged parameters |
| | 2 | | tagged | to scroll to operator tagged parameters only |

Press to tag / untag any accessed parameter. is displayed to indicate the parameter accessed is tagged.

# P735 Backlight

*Controls the LCD backlighting.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | | off |
| | 1 | * | on |
| | 2 | | keypad activated |

The backlight can be forced on or off, or controlled by a programmer, in which case it will turn off 30 seconds after the last key is pressed.

# P736 Date Format

*The order of days and months in date readings in RUN mode.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | DD:MM |
| | 1 | | MM:DD |

This parameter determines the order of days and months of dates shown in RUN mode. It does not affect the way dates are set in PROGRAM mode.

# P737 Primary Reading

*The reading shown on the primary reading display when in RUN mode.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 0 to 3 | | |
| | 1 | * | default reading (P920) based on operation (P001) |
| | 2 | | LCD totalizer (P322, P323) |
| | 3 | | automatically toggle between 1 and 2 |
| Related | • LCD Totalizer (P322 and P323)<br>• P732 Display Delay<br>• P920 Reading Measurement | | |

When this value indicates **toggle** then both readings (default and totalizer) are shown in the time specified in display delay (P732).

# P738 Access Code

*Enter an Access Codes to enable Optional Features.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: up to 999 999 999 |
| Related | • Enabling Optional Features (P343 to P348) |

## P739 Time Zone

*The offset from GMT (Greenwich Mean Time) of local time.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: -999 to 9999 |
| | Preset: 0.0 |

This parameter does not affect any timed events because all times are local. It can be accessed by a remote computer for synchronization purposes. While this parameter will accept the values shown above, valid values are –12.00 to +12.00.

## P741 Communications Timeout

*The maximum time allowed between receiving a request and transmitting the response.*

| | |
|---|---|
| Primary Index | port |
| Values | Range: 0 to 60000 mS |
| | Preset: 5000 mS |

If the maximum time is exceeded, no response will be transmitted, and the action required may not be completed.

# SmartLinx Reserved (750 to 765)

These parameters are reserved for optional SmartLinx communications cards and vary by card. Refer to the SmartLinx documentation to determine if any of them are used.

## P766 Communications Port Security

*The parameter will selectively enable security for a specific communications port.*

| | | | |
|---|---|---|---|
| Primary Index | port | | |
| Values | 0 | * | Preset, security disabled for specified port |
| | 1 | | security enabled for specified port |
| Related | • P767 Communications Lock<br>• P768 PIN Entry Failures<br>• P769 Communications Lock State | | |

## P767 Communications Lock

*A four digit pin which can be modified by keypad or remotely via Modbus or modem if successfully logged in.*

| | |
|---|---|
| Primary Index | global |
| Values | 4 digit PIN |
| Related | • P766 Communications Port Security<br>• P768 PIN Entry Failures<br>• P769 Communications Lock State |

**Note:** P767 applies to communication using Modbus protocol only.

When the correct pin is sent to the SITRANS LUC500 remotely, a safe session is created. If the user makes three unsuccessful attempts to send the correct PIN, the session becomes unsafe, and the connection will be terminated.

Upon termination, the modem will disconnect when using a modem connection.

Three successive unsafe sessions will cause the SITRANS LUC500 to enter intruder lockout state, at which point it is impossible to unlock the unit remotely.

To clear the intruder lockout state, reset the PIN locally using the hand programmer. The same PIN may be entered again.

The following conditions will terminate the safe session, and the PIN will have to be re-entered:

- a modem disconnection
- A timeout as determined by P779 (this applies to both modem and direct connections). If a modem is used, it will go 'on-hook'. A direct connection will revert to a locked state.

## P768 PIN Entry Failures

*Reports number of unsuccessful PIN entries observed by SITRANS LUC500*

| | |
|---|---|
| Primary Index | port |
| Values | Range: 0 to 255 |
| | Can be reset to 0 to observe number of unsuccessful entries |
| Related | • P767 Communications Lock<br>• P769 Communications Lock State |

## P769 Communications Lock State

*Reports the lock state of the SITRANS LUC500 on specified port.*

| | | | |
|---|---|---|---|
| Primary Index | port | | |
| Values | 0 | * | Unlocked |
| | 1 | | Locked |
| | 2 | | Intruder Lockout |
| Related | • P766 Communications Port Security<br>• P767 Communications Lock<br>• P768 PIN Entry Failures | | |

# Communications (P770 to P782)

The SITRANS LUC500 communication ports are configured by a series of parameters that are indexed by port. See the *Communications* section for a complete description of communications set-up.

Communication parameters are indexed to these communication ports, unless otherwise noted:

| Port | Description |
|---|---|
| 1 | RS-232 port (RJ-11 modular telephone) |
| 2 | RS-232 port on terminal block |
| 3 | RS 485 port on optional Auxiliary Input / Output Card |

# P770 Port Protocol

*The communications protocol used between the SITRANS LUC500 and other devices.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | * | Communications port disabled (preset for port 3) |
| | 1 | * | Siemens Milltronics **Dolphin** protocol (preset for port 1) |
| | 2 | | Modbus ASCII slave serial protocol |
| | 3 | * | Modbus RTU slave serial protocol (preset for port 2) |
| | 4 | | ModBus ASCII master |
| | 5 | | ModBus RTU master |
| Related | • Report by Exception (P470 to P472) | | |

The SITRANS LUC500 supports Siemens Milltronics' proprietary **Dolphin** data format (go to **www.siemens.com/processautomation** for more information) as well as the internationally recognized Modbus standard in both ASCII and RTU formats. Other protocols are available with optional SmartLinx cards.

### Report by Exception

If a modem is installed, P770 (Port Protocol) defines protocol for incoming calls. If a slave is currently connected, and a master needs to make an outgoing call, the slave will not be preempted. If the SITRANS LUC500 is the master, it will hang up after exceptions are sent.

# P771 Network Address

*The unique identifier of the SITRANS LUC500 on the network.*

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 0 to 9999 |
| | Preset: 1 |
| Related | • Report by Exception (P470 to P472) |

For devices connected with the Siemens Milltronics protocol this parameter is ignored. For devices connected with a serial Modbus slave protocol, this parameter is a number from 1-247. The network administrator must ensure that all devices on the network have unique addresses. Do not use the value **0** for Modbus communications as this is the broadcast address and is inappropriate for a slave device.

# P772 Baud Rate

*The communication rate with the master device.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 4.8 | | 4800 baud |
| | 9.6 | | 9600 baud (preset and only option for port 3) |
| | 19.2 | * | 19,200 baud (preset for port 2) |
| | 115.2 | * | 115,200 baud (preset for port 1) |
| Related | • Report by Exception (P470 to P472) | | |

This specifies the rate of communication in Kbaud. Any value may be entered but only the values shown below are supported. The baud rate should reflect the speed of the connected hardware and protocol used.

# P773 Parity

*The serial port parity.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | * | No Parity (only option for port 3) |
| | 1 | | Odd Parity |
| | 2 | | Even Parity |
| | 3 | | Mark Parity (=1) |
| | 4 | | Space Parity (=0) |
| Related | • Report by Exception (P470 to P472) | | |

# P774 Data Bits

*The number of data bits per character.*

| | | |
|---|---|---|
| Primary Index | communications port | |
| Values | Range: 5 to 8 | |
| | Preset: 8 (only option for port 3) | |
| | 8 | Modbus RTU |
| | 7 or 8 | Modbus ASCII |
| | 7 or 8 | Dolphin Plus |
| Related | • Report by Exception (P470 to P472) | |

# P775 Stop Bits

*The number of bits following the character message indicating the end of the message.*

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 1 or 2 |
| | Preset: 1 (only option for port 3) |
| Related | • Report by Exception (P470 to P472) |

# P776 Port Flow Control

*The flow control used on the serial port.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | * | No flow control |
| | 1 | | RTS/CTS (Hardware flow control) |
| Related | • Report by Exception (P470 to P472) | | |

The SITRANS LUC500 supports hardware flow control (RTS/CTS) for port 2 only, and does not apply to either ports 1 or 3. If your connected device requires this control then select it. Otherwise, select no flow control.

# P777 Key up Delay

*The delay between asserting RTS and transmitting the first data bit.*

| | |
|---|---|
| Primary Index | communications port |
| Values | Range: 0-3000 milliseconds |
| | Preset: 0 |
| Related | • Report by Exception (P470 to P472) |

This delay is built into the protocol for older radio modems that do not buffer data and require key up time. Consult your modem documentation.

## P778 Modem Available

*Sets the SITRANS LUC500 to use an external modem on the RS-232 port.*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | 0 | * | No modem connected |
| | 1 | | Answer only |
| | 2 | | Dial only |
| | 3 | | Answer / dial |
| Related | • Report by Exception (P470 to P472) | | |

**Note:** For Report by Exception to send reports, either 2 or 3 must be selected.

## P779 Modem Inactivity Timeout

*Sets the time that the unit will keep the modem connected with no activity*

| | | | |
|---|---|---|---|
| Primary Index | communications port | | |
| Values | Range: 0-9999 seconds | | |
| | 0 | * | No timeout |
| Related | • Report by Exception (P470 to P472)<br>• P778 Modem Available | | |

To use this parameter, ensure that P778 (Modem Available)=1. If the line is idle and the P779 Modem Inactivity Timeout expires, then the modem is directed to hang up the line. Ensure that P779 is set longer than the standard polling time of the connected master device. **0** disables the inactivity timer.

## P782 Parameter Index Location

*Determines where index information is stored for the parameter access area.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | 0 | * | Global |
| | 1 | | Parameter-Specific |
| Altered By | • P770 Port Protocol | | |
| Related | • Report by Exception (P470 to P472) | | |

### Global (0)

The primary and secondary index values are global (they affect all of the parameter access area at once) and stored in:

- primary index – R43,999
- secondary index – R43998

### Parameter-Specific (1)

The primary and secondary index values are encoded into the format words found between R46,000 and R46,999. Each format word corresponds with the R44,000-series number in the parameter access map. For example, the format register R46,111 corresponds to the parameter P111 and the value is stored in R44,111. If the Modbus protocol (P770 = 2 or 3) is not used this parameter is ignored.

# Dialler Parameters (P783 to P789)

These parameters define 8 phone numbers to be contacted in the event of an exception as defined by the Report by Exception System (see page 228).

# P783 Dialling Protocol

*The phone dialling protocol used on outgoing connections.*

| | | | |
|---|---|---|---|
| Primary Index | phone number | | |
| Values | 0 | * | Communications port disabled |
| | 2 | | Modbus ASCII slave serial protocol |
| | 3 | | Modbus RTU slave serial protocol |
| | 4 | | ModBus ASCII master |
| | 5 | | ModBus RTU master |
| Related | • Report by Exception (P470 to P472) | | |

# P784 Phone number enable

*The phone dialling specifications.*

| | | | |
|---|---|---|---|
| Primary Index | phone number | | |
| Values | 0 | | disabled |
| | 1 | | tone |
| | 2 | | pulsed |
| Related | • Report by Exception (P470 to P472) | | |

# P785 Phone number

*The phone number that the SITRANS LUC500 will dial to report an exception.*

| | |
|---|---|
| Primary Index | phone number |
| Values | Format: 1 to 16 digits |
| Related | • Report by Exception (P470 to P472) |

To enter a pause in the dialling sequence, press key. This will show as a **P** on the LCD. The display can only show four numbers at a time, so press to scroll the number to the right.

# P786 Number of tries per number

*The number of tries that the System tries to reach a given phone number*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0 to 9999 |
| Related | • Report by Exception (P470 to P472)<br>• P787 Number of Cycles<br>• P788 Delay between tries<br>• P789 Timeout Delay |

If the first number cannot be reached after the desired number of tries, the SITRANS LUC500 will proceed to the next phone number in the list.

# P787 Number of cycles

*The number of times the System cycles through all the phone numbers.*

| | | | |
|---|---|---|---|
| Primary Index | global | | |
| Values | Range: 0 to 9999 | | |
| | 0 | | Non-stop |
| Related | • Report by Exception (P470 to P472)<br>• P786 Number of tries per number | | |

## P788 Delay between tries

*The number of seconds between each retry.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 0 to 9999 |
| Related | • Report by Exception (P470 to P472)<br>• P786 Number of tries per number |

This delay defined is used between dialling attempt as defined by P786. (Number of Tries per Number). It does not define the delay between each cycle through the phone list as defined by P787 (Number of Tries per Cycle).

## P789 Timeout delay

*The number of seconds before timing out on connect attempts.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 1 to 9999 |
| | Default: 30 seconds |
| Related | • P786 Number of tries per number |

After the timeout delay has expired, the unit will use the same phone number to reconnect until reaching the value in P786 (Number of tries per number).

# SmartLinx Hardware Testing (P790 – P795)

These parameters are used to test and debug a SmartLinx card (if installed).

## P790 Hardware Error

*The results of ongoing hardware tests in the communications circuitry.*

| | | | |
|---|---|---|---|
| **Primary Index** | Global | | |
| **Values** | PASS | * | No errors |
| | FAIL | | Error occurred communicating with card; device will try to reinitialize communications with card. If message continues, record values in P791 and P792 and contact your local Siemens Milltronics representative. |
| | ERR1 | | No module installed, or module not supported; communications have been disabled |
| **Related** | • P791 Hardware Error Code<br>• P792 Hardware Error Count | | |

If **FAIL** or **ERR1** is displayed in P790 (Hardware Error), go to P791 (Hardware Error Code) and P792 (Hardware Error Count) for information about the error.

## P791 Hardware Error Code

*Indicates the precise cause of **Fail** or **ERR1** condition from P790.*

| | | | |
|---|---|---|---|
| **Primary Index** | Global | | |
| **Values** | 0 | * | No error |
| | Any other value | | Error code; provide this code to your Siemens Milltronics representative for troubleshooting |
| **Related** | • P790 Hardware Error | | |

## P792 Hardware Error Count

*A count that increments by **1** each time **Fail** is reported in P790 (Hardware Error).*

| | |
|---|---|
| **Primary Index** | Global |
| **Values** | Range: 0 to 9999 |
| | Error count; provide this number to your Siemens Milltronics representative for troubleshooting. |
| **Related** | • P790 Hardware Error |

## P794 SmartLinx Module Type

*This parameter is used to identify the module type when SmartLinx is used. If you are not using SmartLinx, this parameter is not functional. Please see the associated SmartLinx instruction manual for a full description of this parameter.*

## P795 SmartLinx Protocol

*This parameter is used to identify the protocol when SmartLinx is used. If you are not using SmartLinx, this parameter is not functional. Please see the associated SmartLinx instruction manual for a full description of this parameter.*

# Echo Processing (P800 to P807)

## P800 Near Blanking

*The space close to the transducer face which cannot be measured*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |

| | |
|---|---|
| Values | Range: 0.000 to 9999 |
| | Preset: 0.300m (Most transducers)<br>0.450m (XCT-8, XCT-12) |
| Related | • P006 Empty<br>• P007 Span<br>• P833 TVT Start Min |

Use this feature if the surface is reported to be near the transducer face but is in fact much further away. Extend this value when changing transducer location, mounting, or aiming. It cannot correct measurement problems. Ensure that Span (P007) < Empty(P006) – Near Blanking (P800).

**Measurement difficulties can be caused by:**

- Vessel obstruction partly blocking the transducer acoustic beam
- Transducer standpipe mount is too narrow for its length or not cut at 30 to 45°
- Transducer mounting which is resonant at the transducer frequency (ringing)

# P801 Range Extension

*Allows the material level to fall below the Empty setting without reporting LOE.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0.000 to 9999 | |
| | Preset: 20% of Span (P007) | |
| Related | • P005 Units<br>• P006 Empty<br>• P007 Span<br>• P004 Transducer | |

This feature is useful in OCM applications where the Empty level is set to the bottom of the weir, and above the bottom of the channel, and should be used if the surface monitored can fall past the Empty (P006) level in normal operation. The value is added to Empty (P006) and can be greater than the range of the transducer. If the surface monitored can extend beyond Empty (P006), increase Range Extension (in Units (P005) or % of Span) such that Empty plus Range Extension is greater than the transducer face to furthest surface to be monitored distance. This is often the case with OCM when using weirs and some flumes.

# P802 Submergence Transducer

*Used when transducer is installed with a submergence shield*

| | Single Point Model | | Dual Point Model |
|---|---|---|---|
| Primary Index | global | | transducer |
| Values | 0 | * | off |
| | 1 | | submergence transducer |
| Related | • P006 Empty<br>• P071 Failsafe Material Level<br>• Relays | | |

When a transducer is submerged, the submergence shield traps an air pocket that creates a special echo. Setting P802 to 1 directs the SITRANS LUC500 to look for the special echo. The SITRANS LUC500 recognizes the echo and advances the reading to the highest level and operates displays and outputs accordingly. This feature is particularly useful when power is returned while the transducer is submerged.

# P803 Shot / Pulse Mode

*Determines what type of ultrasonic shots are fired.*

| | Single Point Model | | Dual Point Model |
|---|---|---|---|
| Primary Index | global | | transducer |
| Values | 1 | | short |
| | 2 | * | short and long |
| Related | • P006 Empty<br>• P805 Echo Confidence<br>• P804 Confidence Threshold<br>• P852 Short Shot Range | | |

Use this feature to increase SITRANS LUC500 response when the monitored surface is close to the transducer face. Select **short and long** to have short and long acoustic shots fired for each measurement, regardless of the transducer to surface distance. Select **short** to have only short shots fired if the Echo Confidence (P805) produced by a short shot exceeds the short Confidence Threshold (P804) and the monitored surface is always within the Short Shot Range (P852).

# P804 Confidence Threshold

*Determines which echoes are evaluated by software.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0 to 99:0 to 99 | |
| | Preset: 10:5 | |
| Related | • P805 Echo Confidence | |

Use this feature when an incorrect material level is reported. The short and long shot Confidence Thresholds are preset to 10 and 5 respectively. When Echo Confidence (P805) exceeds the Confidence Threshold, the echo is evaluated by Sonic Intelligence®. Values are entered as two numbers separated by a decimal point. The first number is the short shot confidence and the second number is the long shot confidence.

**Note:** The decimal point is replaced with a colon (:) on the display.

# P805 Echo Confidence

*Displays the echo confidence of the measurement echo from the last shot.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Format: x:y (view only) |
| | x = short (0 to 99) |
| | y = long (0 to 99) |
| Related | • P804 Confidence Threshold<br>• P830 TVT Type |

Use this feature to monitor the effect of transducer aiming, location, and mechanical transducer / mounting isolation.

Both short and long shot Echo Confidence is displayed. (To display this value in the auxiliary display while the unit is running, press for 4 seconds).

| Display | Description |
|---|---|
| “x:--” | short shot confidence value, (long shot not used). |
| “--:y” | long shot confidence value, (short shot not used). |

| | |
|---|---|
| “x:y” | short and long shot confidence values (both used). |
| E | transducer cable is open or short circuited. |
| "--:--" | no shots were processed for Sonic Intelligence® evaluation. |

# P806 Echo Strength

*Displays the strength (in dB above 1 uV RMS) of the echo which was selected as the measurement echo.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Format: 0 to 9 (view only) |

# P807 Noise

*Displays the average and peak ambient noise (in dB above 1 uV RMS) being processed.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Format: x:y (view only) |
| | x = average (-99 to 99) |
| | y = peak (-99 to 99) |

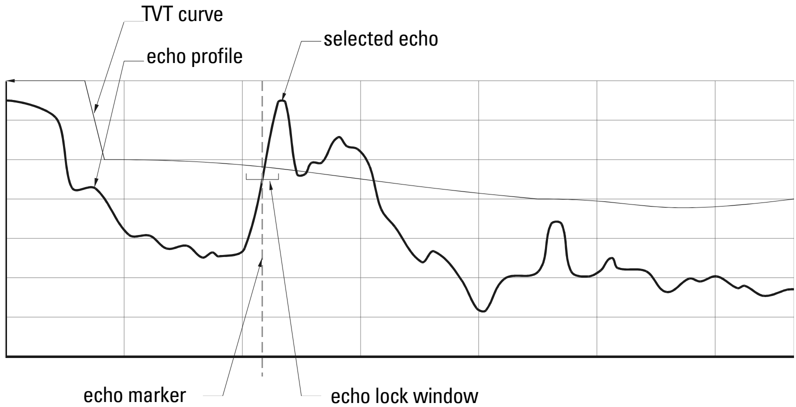
The noise level is a combination of transient acoustic noise and electrical noise (induced into the transducer cable or receiving circuitry). See *Noise Problems* on page 302.

# Advanced Echo Processing (P810 to P825)

**Note:** The following parameters are for authorized Siemens Milltronics Service personnel or technicians familiar with Siemens Milltronics echo processing techniques.

### Anatomy of an Echo Profile

The relevant parts of an echo profile are listed here. These are visible in either Dolphin Plus or an oscilloscope.




## P810 Scope Displays

*Captures echo profiles for display on an oscilloscope.*

| | | |
|---|---|---|
| Primary Index | transducer | |
| Values | Display: P, C, n, u, _ | |
| | Preset: _ _ _ _ (display is off) | |
| Related | • P832 TVT Shaper Adjust | |

Use this feature to monitor the effects of Echo Processing changes.

Connect an oscilloscope to Display Board TP1, TP2, and TP3.

| | |
|---|---|
| Sweep = | 10 us / div. to 1 ms / div. (x 100 for real time) |
| Amplitude = | 1 V / div. |
| Trigger = | external |

## Any combination of the following Scope Displays are available.

| Display | Symbol | | | |
|---|---|---|---|---|
| | P | C | n | u |
| Echo Profile<br>TVT Curve<br>Echo Marker<br>Echo Lock Window | | | | |

### There are two methods of selecting the Scope Displays:

**Scrolling**

1. Press [▲%] to display the Auxiliary Function symbol.
2. Press [▲] or [▼] to access the desired Reading display symbols.
3. Press [↵] with the desired display symbols displayed.

**1/0 Values**

Alternatively, a 4 digit binary value may be entered, where a **0** turns the associated signal display OFF, and a **1** turns the display ON.

e.g. 1110 = PCn_ = Echo Profile, TVT Curve, and Echo Marker displays on, Echo Lock Window display off.

See *Echo Processing* on page 295 for more information.

Use the Scope Displays after pressing [⏚] (PROGRAM mode) to observe the result of parameter alterations. (Take several measurements to verify repeatability and overcome Echo Lock (P711) restrictions).

## P815 Echo Time Filtered

*The time (in ms) from the transmission of the pulse, to when it is processed.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.0 to 9999 (view only) |
| Related | • P816 Echo Time Raw |

## P816 Echo Time Raw

*The time (in ms) from the transmit pulse to the echo processed.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.0 to 9999 (view only) |
| Related | • P815 Echo Time Filtered |

# Profile Pointer (P817 to P825)

When one of these parameters are accessed, the display changes to a Profile Pointer display. The Profile Pointer may be moved to a number of points on the Echo Profile, to gain information relevant to the parameter.

To move the Profile Pointer to a specific point, enter the desired value and it will move to the nearest acceptable Echo Profile point. Alternatively, to scroll the Profile Pointer along the Echo Profile:

1. Press [▲%] to display the Auxiliary Function symbol.
2. Press [P_] or [P] to move the Profile Pointer to the left or right respectively.

When the Profile Pointer Parameters are exited and the RUN mode is entered, the display automatically changes back to the Echo Lock Window.

# P817 Profile Pointer Time

*The time (in ms) from the transmit pulse to the Profile Pointer.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 (view only) | |
| Related | • P818 Profile Pointer Distance<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | |

# P818 Profile Pointer Distance

*The distance between the transducer face and the Profile Pointer.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 (view only) | |
| Related | • P817 Profile Pointer Time<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | |

# P819 Profile Pointer Amplitude

*The amplitude (in dB above 1 uV) of the Echo Profile at the Pointer position.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 00 to 99 (view only) | |
| Related | • P817 Profile Pointer Time<br>• P818 Profile Pointer Distance<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | |

# P820 Algorithm

*Chooses the algorithm to generate the measured value from the profile.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 1 | | ALF = flat Area, Largest, and First average |
| | 2 | | A = flat Area only |
| | 3 | | L = flat Largest only |
| | 4 | | F = flat First only |
| | 5 | | AL = flat Area and Largest average |
| | 6 | | AF = flat Area and First average |
| | 7 | | LF = flat Largest and First average |
| | 8 | * | bLF = smooth Largest or First |
| | 9 | | bL = smooth Largest only |
| | 10 | | bF = smooth First only |
| Related | • P817 Profile Pointer Time<br>• P818 Profile Pointer Distance<br>• P819 Profile Pointer Amplitude<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | | |

Use this to select the algorithm(s) the Sonic Intelligence® echo selection is based on. Use P805 Echo Confidence (page 277) to determine which algorithm gives the highest confidence under all level conditions. If the wrong echo is processed, observe the echo processing displays and select an alternate algorithm, either by entering the numeric value desired, or as below:

1. Press [▲%] to display the Auxiliary Function symbol.
2. Press [▲] or [▼] to access the desired Reading display symbols.
3. Press [↵] with the desired algorithm is displayed.

# P821 Spike Filter

*Dampens spikes in the echo profile to reduce false readings.*

| Primary Index | Single Point Model | | Dual Point Model |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | | off |
| | 1 | * | on |
| Related | • P817 Profile Pointer Time<br>• P818 Profile Pointer Distance<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | | |

Use P821 if interference spikes are on the long shot Echo Profile display.

# P822 Narrow Echo Filter

*Filters out echoes of a specific width.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | 0 = off (preset) | |
| | greater = wider | |
| Related | • P817 Profile Pointer Time<br>• P818 Profile Pointer Distance<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P823 Reform Echo<br>• P825 Echo Marker Trigger | |

Use this for transducer acoustic beam interference (e.g. ladder rungs). Enter the width of false echoes (in ms), to be removed from the long shot Echo Profile. When a value is keyed in, the nearest acceptable value is entered.

# P823 Reform Echo

*Smooths jagged peaks in the echo profile.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | 0 = off (preset) | |
| | greater = wider | |
| Related | • P817 Profile Pointer Time<br>• P818 Profile Pointer Distance<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P825 Echo Marker Trigger | |

Use this feature when monitoring solids (P002 = 2) if the reported level fluctuates slightly though the monitored surface is still. Enter the amount (in ms) of long shot Echo Profile smoothing required. When a value is keyed in, the nearest acceptable value is entered.

# P825 Echo Marker Trigger

*The point on the primary echo on which the measured value is based.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 5 to 95% | |
| | Preset: 90% when P002 = 1 (liquid)<br>50% when P002 = 2 (solid) | |
| Related | • P817 Profile Pointer Time<br>• P818 Profile POinter Distance<br>• P819 Profile Pointer Amplitude<br>• P820 Algorithm<br>• P821 Spike Filter<br>• P822 Narrow Echo Filter<br>• P823 Reform Echo | |

Use this feature if the reported material level fluctuates slightly, due to a variable rise in the leading edge of the true echo on the Echo Profile.

Enter the value (in percent of echo height) to ensure the Echo Lock Window intersects the Echo Profile at the sharpest rising portion of the Echo Profile representing the true echo. This value is preset to 50%.

# Advanced TVT Adjustment (P830 to P835)

The following parameters are for authorized Siemens Milltronics Service personnel or Technicians familiar with Siemens Milltronics echo processing techniques.

## P830 TVT Type

*Selects the TVT Curve used.*

| Primary Index | **Single Point Model** | | **Dual Point Model** |
|---|---|---|---|
| | global | | transducer |
| Values | 1 | | TVT Short Curved |
| | 2 | | TVT Short Flat |
| | 3 | | TVT Long Flat |
| | 4 | | TVT Long Smooth Front |
| | 5 | | TVT Long Smooth |
| | 6 | | TVT Slopes |
| Altered By | • P002 Material | | |
| Related | • P805 Echo Confidence<br>• P835 TVT Slope Min | | |

Select the TVT type which gives the highest confidence (P805) under all level conditions. Use this parameter with caution, and do not use **TVT Slopes** with the **bF** or **bLF** Algorithm (P820).

## P831 TVT Shaper

*Turns the TVT Shaper **ON** or **OFF**.*

| Primary Index | **Single Point Model** | | **Dual Point Model** |
|---|---|---|---|
| | global | | transducer |
| Values | 0 | * | off |
| | 1 | | on |
| Related | • P832 TVT Shaper Adjust | | |

Turn the TVT Shaper **ON** before using P832. Turn the TVT Shaper **ON** and **OFF** while monitoring the effect to pick up the true echo.

## P832 TVT Shaper Adjust

*Allows manual adjustment of the TVT curve.*

| Primary Index | **Single Point Model** | **Dual Point Model** |
|---|---|---|
| | breakpoint | transducer and breakpoint |
| Values | Range: -50 to 50 | |
| | Preset: 0 | |
| Related | • P810 Scope Displays<br>• P831 TVT Shaper | |

Use this feature to bias the shape of the TVT curve to avoid crossing false echoes from fixed objects.

Adjustment to this parameter is best done while viewing the echo profile with Dolphin Plus. Refer to the Dolphin Plus online help for details. If Dolphin Plus is not available, then an oscilloscope can be used. When using an oscilloscope, the Echo Lock Window display becomes the TVT Curve Pointer. See *P810 Scope Displays* on page 279 for more information.

The TVT curve is divided into 40 breakpoints, accessible by enabling the point number as the breakpoint index field. Each breakpoint is normalized to a value of 0, as displayed in the parameter value field. By changing the breakpoint value, up or down, the intensity of the bias applied to that breakpoint of the curve is respectively changed. By changing the value of adjacent breakpoints, the effective bias to the shaper can be broadened to suit the desired correction. In the case of multiple false echoes, shaping can be applied along different points of the curve. Shaping should be applied sparingly in order to avoid missing the true echo.

**To change a breakpoint:**

1. Confirm that P831, TVT shaper, is ON.
2. Go to P832
3. Press [⇔] twice to highlight the index value
4. Press [▲] or [▼] to scroll through the 40 points (or type in the desired point)
5. Enter the value from –50 to 50
6. Press [↵]

# P833 TVT Start Min

*Use this feature to adjust the TVT Curve height to ignore false echoes (or pick up true echoes) near the start of the Echo Profile.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: –30 to 225 | |
| | Preset: 50 | |
| Related | • P800 Near Blanking<br>• P834 TVT Start Duration | |

Enter the minimum TVT Curve start point (in dB above 1 uV RMS).

This feature should only be used if increased Near Blanking (P800) would extend farther than desired into the measurement range.

# P834 TVT Start Duration

*Use this feature in conjunction with TVT Start Min (P833) to ignore false echoes (or pick up true echoes) near the start of the Echo Profile.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0 to 9999 | |
| | Preset: 30 | |
| Related | • P833 TVT Start Min<br>• P835 TVT Slope Min | |

Enter the time (in ms) for the TVT Curve to decrease from the TVT Start Min (P833) point to the TVT Curve baseline.

# P835 TVT Slope Min

*Enter the minimum slope (in dB/s) for the middle of the TVT Curve.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0 to 9999 | |
| | Preset: 200 | |
| Related | • P830 TVT Type<br>• P834 TVT Start Duration | |

Use this feature to adjust the slope declination, and use it in conjunction with TVT Start Duration (when a long flat TVT Type is selected) to ensure the TVT Curve remains above the false echoes in the middle of the Echo Profile. Alternatively, if TVT Type is set for **TVT Slopes** (P830 = 6), preset is 2000.

# Advanced Shot Adjustment (P840 to P852)

**Note:** These parameters are for Siemens Milltronics service personnel only.

## P840 Short Shot Number

*The number of short shots to be fired (and results averaged) per transmit pulse.*

| Primary Index | Single | Dual |
|---|---|---|
| | global | transducer |
| Values | Range: 0 to 100 | |
| | Preset: 1 | |
| Related | • P841 Long Shot Number<br>• P842 Short Shot Frequency<br>• P844 Short Shot Width<br>• P850 Short Shot Bias<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

## P841 Long Shot Number

*Enter the number of long shots to be fired (and results averaged) per transmit pulse.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0 to 200 | |
| | Preset: 5 | |
| Altered By | • P003 Maximum Process Speed | |
| Related | • P840 Short Shot Number<br>• P843 Long Shot Frequency<br>• P845 Long Shot Width | |

This value is automatically altered by Maximum Process Speed (P003).

# P842 Short Shot Frequency

*Adjust the short shot transmit pulse frequency (in kHz).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 42.00 to 46.00 | |
| Altered By | • P004 Transducer | |
| Related | • P840 Short Shot Number<br>• P844 Short Shot Width<br>• P850 Short Shot Bias<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

This feature is automatically altered when Transducer (P004) is altered.

# P843 Long Shot Frequency

*Adjust the long shot transmit pulse frequency (in kHz).*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 42.00 to 46.00 | |
| Altered By | • P004 Transducer | |
| Related | • P841 Long Shot Number<br>• P842 Short Shot Frequency<br>• P843 Long Shot Frequency<br>• P845 Long Shot Width | |

This feature is automatically altered when Transducer (P004) is altered.

# P844 Short Shot Width

*Adjust the width (in ms) of the short shot transmit pulse.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 5.000 | |
| Altered By | • P004 Transducer | |
| Related | • P841 Long Shot Number<br>• P842 Short Shot Frequency<br>• P845 Long Shot Width<br>• P850 Short Shot Bias<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

This feature is automatically altered when Transducer (P004) is altered.

# P845 Long Shot Width

*Adjust the width (in ms) of the long shot transmit pulse.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 5.000 | |
| Altered By | • P004 Transducer | |
| Related | • P841 Long Shot Number<br>• P844 Short Shot Width<br>• P843 Long Shot Frequency | |

This feature is automatically altered when Transducer (P004) is altered.

## P850 Short Shot Bias

*Use this feature to slant the echo evaluation in favour of the short shot echo when both short and long shots are evaluated (see Shot Mode, P803).*

| | | |
|---|---|---|
| Primary Index | **Single Point Model** | **Dual Point Model** |
| | global | transducer |
| Values | Range: 0 to 100 | |
| | Preset: 20 | |
| Related | • P803 Shot / Pulse Mode<br>• P840 Short Shot Number<br>• P842 Short Shot Frequency<br>• P844 Short Shot Width<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

## P851 Short Shot Floor

*Enter the minimum echo strength (in dB above 1 uV), derived from a short shot, to be considered for evaluation.*

| | | |
|---|---|---|
| Primary Index | **Single Point Model** | **Dual Point Model** |
| | global | transducer |
| Values | Range: 0 to 100 | |
| | Preset: 50 | |
| Related | • P840 Short Shot Number<br>• P842 Short Shot Frequency<br>• P844 Short Shot Width<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

## P852 Short Shot Range

*Enter the maximum distance in Units (P005) to be measured using short shot echoes.*

| | | |
|---|---|---|
| Primary Index | **Single Point Model** | **Dual Point Model** |
| | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Altered By | • P004 Transducer | |
| Related | • P840 Short Shot Number<br>• P842 Short Shot Frequency<br>• P844 Short Shot Width<br>• P851 Short Shot Floor<br>• P852 Short Shot Range | |

This feature is automatically altered when Transducer (P004) is altered.

# Test (P900 to P913)

**Note:** Test parameters are intended for use by Siemens Milltronics service personnel .

## P900 Software Revision #

*View the EPROM Rev. #.*

| | |
|---|---|
| Primary Index | global |
| Values | Range: 00.00 to 99.99 (view only) |

# P901 Memory

*Press to activate the SITRANS LUC500 memory test.*

| | | |
|---|---|---|
| Primary Index | global | |
| Values | Display: view only | |
| | PASS | (memory test successful) |
| | F1 | RAM |
| | F2 | NOVRAM |
| | F3 | FLASH data |
| | F4 | FLASH code |

# P902 Watchdog

*Press to put the CPU into an infinite loop to test the watchdog timer.*

On successful completion (10 seconds) the RUN mode is entered and the SITRANS LUC500 is reset. Programming is kept and the unit responds as if there had been a power failure.

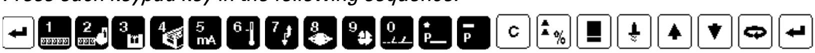
# P903 Display

*Press to activate the display test.*

All LCD segments and symbols are temporarily displayed.

# P904 Keypad

*Press each keypad key in the following sequence:*



As each key is pressed, the associated keypad number is displayed. On successful test completion, PASS is displayed. FAIL is displayed if a key is pressed out of sequence or the programmer keypad malfunctions.

# P905 Transmit Pulse

*This feature may be used to monitor the transmit pulse with an oscilloscope connected to the transducer terminals.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 42 to 46 kHz (view only) | |
| Altered By | • P004 Transducer | |

Press to supply repeated transmit pulses, at the frequency entered, to the transducer and / or view the transducer operating frequency (automatically altered by (P004) Transducer) for the Point Number displayed.

# P906 RS-232 Port, Terminal Block, Port 2

*Press to test the RS-232 port on the terminal block.*

An external device must be connected to the RS-232 port for this test. On successful completion, PASS is displayed, otherwise it is FAIL.

## P907 Infrared Interface

*Press ↵ to activate the programmer interface (two way infrared communications) test.*

On successful test completion, PASS is displayed, otherwise it is FAIL.

## P909 RS-232 Port, RJ-11, Port 1

*Press ↵ to test the RS-232 port on the RJ-11 connector.*

An external device must be connected to the RS-232 port for this test. On successful completion, PASS is displayed, otherwise it is FAIL.

## P911 mA Output Value

*Access this parameter to display the current value of the mA output.*

| | |
|---|---|
| Primary Index | mA output |
| Values | Range: 0.00 to 25.00 |
| Related | • P200 mA Output Range<br>• P201 mA Output Function |

Additionally, this feature may be used to enter a desired value. The mA output immediately assumes the value entered regardless of any restrictions programmed.

## P912 Transducer Temperature

*Use this feature to display the temperature in °C (as monitored by the connected transducer).*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: -50 to +150 |

Err is displayed if the transducer is not equipped with an internal temperature sensor.

## P913 Sensor Temperature

*Access this parameter to display the temperature in °C (as monitored by the TS-3).*

| | |
|---|---|
| Primary Index | Global |
| Values | Range: -50 to +150 |

OPEn is displayed if a TS-3 is not connected.

## P914 mA Input

Use this feature to display the mA input value (in mA).

| | |
|---|---|
| Primary Index | mA input |
| Values | Range: 0.000 to 24.00 |

# Measurement (P920 to P927)

All of these parameters are available in RUN mode and used to verify programming. See *Readings in RUN Mode* on page 35.

The range and values shown for each of these parameters depends on the Operation (P001) chosen. The readings for each operation are listed below.

#### To Access in Run Mode

1. Ensure the device is in run mode
2. Press [P key]
   The Auxiliary Reading field becomes underscores P_ _ _
3. Type the parameter number
   The field changes to the value of the specified parameter

These parameters are also available in simulation mode. See *Testing the Configuration* on page 117 for instructions on how to control the simulation direction and rate.

# P920 Reading Measurement

*Corresponds to the final reading after all programming is applied.*

| | |
|---|---|
| Primary Index | level point |
| Values | Range: -999 to 9999 |

In general this means that: P920 = Reading x P061 + P062

### Reading Measurements by Operation

| P001 | P050 = 0 | P050 ≠ 0 |
|---|---|---|
| 0 – Off | - - - - | - - - - |
| 1 – Level | P921 | P924 |
| 2 – Space | P922 | 100% - P924 |
| 3 – Distance | P927 | P927 |
| 4 – Difference | P921 (indexed) | P921 (indexed) |
| 5 – Average | P921 (indexed) | P921 (indexed) |
| 6 – OCM | P925 | P925 |
| 7 – Pump Totalizer | P924 | P924 |

# P921 Material Measurement

*The distance in Units (P005) or % of Span (P007), between Empty (P006) and the monitored surface.*

| | |
|---|---|
| Primary Index | level point |
| Values | Range: -999 to 9999 |
| Related | • P005 Units<br>• P006 Empty<br>• P007 Span |

# P922 Space Measurement

*The distance between the monitored surface and Span (P007).*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.000 to 9999 |
| Related | • P007 Span |

# P923 Distance Measurement

*The distance between the monitored surface and the transducer face.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.000 to 9999 |

# P924 Volume Measurement

*The calculated vessel capacity in Max Volume (P051) or % of Max Volume.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P051 Maximum Volume | |

# P925 Flow Measurement

*The calculated flowrate in Max Flow (P604) units or % of Max Flow.*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: 0.000 to 9999 | |
| Related | • P604 Maximum Flow | |

# P926 Head Measurement

*Corresponds to Head (the distance from Zero Head (P605) to the monitored surface) in Units (P005) or % of Span (P007).*

| | Single Point Model | Dual Point Model |
|---|---|---|
| Primary Index | global | transducer |
| Values | Range: -999 to 9999 | |
| Related | • P005 Units<br>• P007 Span<br>• P605 Zero Head | |

# P927 Distance Measurement

*The distance between the surface and the transducer face.*

| | |
|---|---|
| Primary Index | transducer |
| Values | Range: 0.000 to 9999 in units or % of Empty |
| Related | • P005 Units<br>• P006 Empty |

Use P923 unless the distance information is required in percent.

# P928 Scaled mA Input Measurement

*The scaled mA input converted to a reading (based on Span).*

| | |
|---|---|
| Primary Index | mA input |
| Values | Range: 0.000 to 9999 in units or % of Span |
| Related | • P007 Span<br>• P914 mA Input |

# Master Reset (P999)

*This feature resets all parameters to original values.*

| Primary Index | Single Point Model | Dual Point Model |
|---|---|---|
| | global | transducer |
| Values | Range: 0.000 to 9999 | |

Use this feature prior to initial programming if arbitrary Parameter Values were used during a bench test, or after upgrading the software. Following a Master Reset, complete reprogramming is required.

In single point models, only the Master Reset option is available. Dual point models can reset each point individually, as well as Master Resets.

To perform a Master Reset on a single point model, access P999 and press C ↵. **C.ALL** is shown until the reset is complete.

To perform a Master Reset on a dual point model, access P999 and set the index to **00**. Press C ↵. **C.ALL** is shown until the reset is complete.

To reset each point individually on a dual point model, acces P999 and set the index to **01** or **02**. Press C ↵. **C.ALL** is shown until the reset is complete.

Parameters

# Appendix A–Index Types

## Index types

| Name | Description | # of indexes |
|---|---|---|
| Global | This parameter applies to the entire unit | n/a |
| View only | This parameter can not be set, only viewed | n/a |
| Breakpoint | Indexed by breakpoint | 10 or 32 |
| CSO Log | Indexed by CSO log entry | 20 |
| Dimension | Indexed by PMD dimension | up to 7 |
| Discrete Input[1] | Indexed by discrete input | 8 or 16 |
| Data Logging | Indexed by Data Logging | 10 |
| Echo Profile | Indexed by stored echo profile | 10 |
| Trigger | Indexed by Trigger | 32 |
| Level Point[2] | Indexed by level point | 1, 2 or 3 |
| mA input[1] | Indexed by mA input | 1, 3 or 5 |
| mA output[1] | Indexed by mA output | 0, 2 or 4 |
| Comm. Port | Indexed by communications port | 2 |
| Phone Number | Indexed by phone number | 8 |
| Relay | Indexed by relay | 5 |
| Report Generation | Indexed by report | 32 |
| Transducer[3] | Indexed by transducer | 1 or 2 |
| Flow Condition | Indexed by flow condition | 4 |

1. The number of indexes depends on the option card installed.
2. The three level points are: transducer 1, transducer 2, and the calculated point which can be difference (P001=4) or average (P001=5). Single Point Mode (standard) has one level point unless its operation (P001) is set for difference (P001=4) or average (P005=5). In those cases it has three level points (transducer 1, transducer 2, and the calculated point).
3. The number of indexes available in Single Point Mode (standard) is typically 1, but can be expanded to 2 if Operation (P001) is set for DPD (P001=4), DPA (P001=5, DPS (P001=10)).
   In Dual Point Mode (optional), the number of available indexes is always 2.

# Appendix B–Technical Reference

## Transmit Pulse

The transmit pulse consists of one or more electrical shot pulses, which are supplied to the transducer connected to the SITRANS LUC500 terminals. The transducer fires an acoustic shot for each electrical pulse supplied. After each shot is fired, sufficient time is provided for echo (shot reflection) reception, before the next (if applicable) shot is fired. After all shots of the transmit pulse are fired, the resultant echoes are processed. The transmit pulse shot number, frequency, duration, delay, and associated measurement range are defined by parameters P803 and P840 to P852.

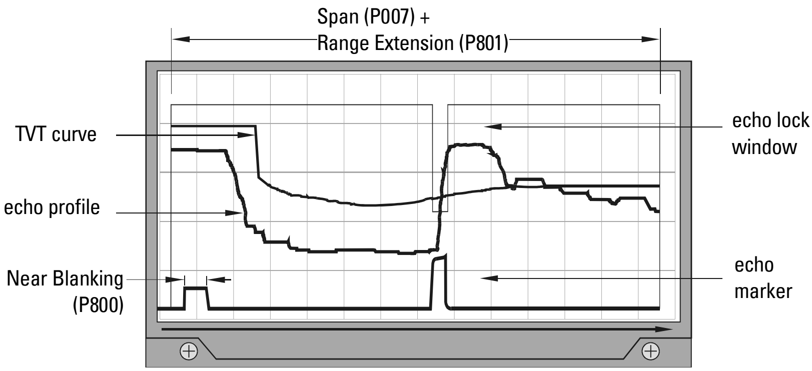
## Echo Processing

Echo processing consists of echo enhancement, true echo selection, and selected echo verification.

Echo Enhancement is achieved by filtering (P821 and P822) and reforming (P823) the echo profile (P810). The true echo (echo reflected by the intended target) is selected when that portion of the echo profile meets the evaluation criteria of Sonic Intelligence®. Insignificant portions of the echo profile outside of the measurement range (Span P006 + Range Extension P801), below the TVT Curve (P830, and P832 to P835), and less than the Confidence Threshold (P804) and Short Shot Floor (P851) are automatically disregarded. The remaining portions of the Echo Profile are evaluated using the Algorithm (P820) and Short Shot Bias (P850). The Echo Profile portion providing the best Echo Confidence (P805), is selected.

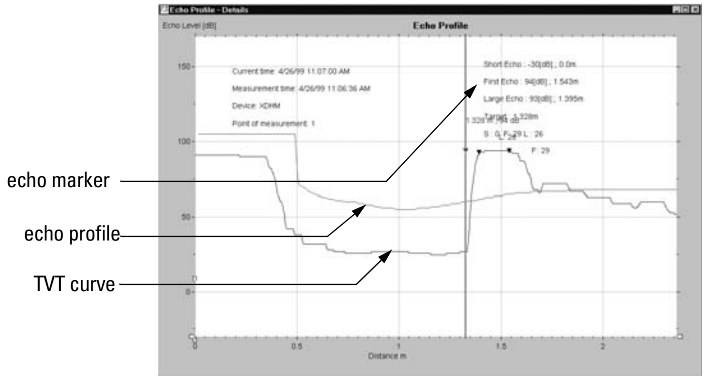
True echo verification is automatic. The position (relation in time after transmit) of the new echo is compared to that of the previously accepted echo. When the new echo is within the Echo Lock Window (P713), it is accepted and displays, outputs, and relays are updated per the Fuzz Filter (P710) and Rate Parameters (P700 to P703). If the new echo is outside of the Window, it is not accepted until Echo Lock (P711) requirements are satisfied.

### Scope Display (P810)




Appendix B

### Dolphin Plus Display




# Distance Calculation

To calculate the transducer to material level (object) distance, the transmission medium (atmosphere) sound velocity (P653) is multiplied by the acoustic transmission to reception time period. This result is divided by 2 to calculate the one way distance.

Distance = Sound Velocity x Time / 2

The Reading displayed is the result of performing any additional modification to the calculated distance (as determined by Operation P001, Units P005, Volume Conversion, P050 to P054, Reading, P060 to P063, OCM, P600 to P611, and/or Totalizer P622 to P633 parameters).



# Sound Velocity

The sound velocity of the transmission medium is affected by the type, temperature, and vapour pressure of the gas or vapour present. As preset, the SITRANS LUC500 assumes the vessel atmosphere is air at +20 °C (+68 °F). Unless altered, the sound velocity used for the distance calculation is 344.1 m/s (1129 ft/s).

Variable air temperature is automatically compensated when a Siemens Milltronics ultrasonic / temperature transducer is used. If the transducer is exposed to direct sunlight, use a sunshield or a separate TS-3 temperature sensor.

Also, if the temperature varies between the transducer face and the liquid monitored, use a TS-3 temperature sensor, (submerged in the liquid) in combination with an ultrasonic / temperature transducer. Set Temp Source (P660) for **both**, to average the transducer and TS-3 measurements.

Atmosphere composition other than air can pose a challenge for ultrasonic level measurement. However, excellent results may be obtained if the atmosphere is homogeneous (well mixed), at a fixed temperature, and consistent vapour pressure, by performing a Sound Velocity Calibration (P651).

The SITRANS LUC500 automatic temperature compensation is based on the sound velocity / temperature characteristics of air and may not be suitable for the atmosphere present. If the atmosphere temperature is variable, perform frequent Sound Velocity Calibrations to optimize measurement accuracy.

Sound Velocity calibration frequency may be determined with experience. If the sound velocity in two or more vessels is always similar, future calibrations may be performed on one vessel and the resultant Velocity (P653) entered directly for the other vessel(s).

If the sound velocity of a vessel atmosphere is found to be repeatable at specific temperatures, a chart or curve may be developed. Then, rather than performing a Sound Velocity Calibration each time the vessel temperature changes significantly, the anticipated Velocity (P653) may be entered directly.

# Scanning

When the ERS is programmed for Differential, Average, or Sum level Operation (P001 = 4, 5, or 10), two transducers must be used. In this case, the transmit pulse is time shared between the transducers via the Scanner relay.

When echo processing is complete, (if more than 1 vessel is monitored) the scanning relay changes state to supply the transmit pulse to the other transducer after the Scan Delay (P727).

Scan Delay is automatically set by Maximum Process Speed (P003). When high speed scanning is required (sometimes the case for equipment position monitoring), the Scan Delay may be reduced. Reduce the Scan Delay only as required, otherwise premature scanning relay fatigue could occur.

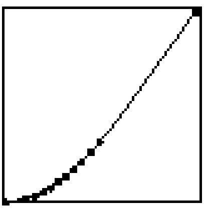


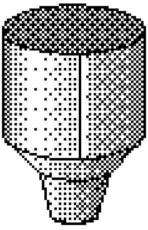
# Volume Calculation

The unit provides a variety of volume calculation features (P050 to P055).

If the vessel does not match any of the 8 preset Tank Shape calculations, a Universal Volume calculation may be used. Use the level/volume graph or chart provided by the vessel fabricator (or create one based on the vessel dimensions). Based on the graph, choose the Universal Volume calculation, and select the level vs. volume breakpoints to be entered (32 max). Generally, the more breakpoints entered, the greater the accuracy.

**Universal, Linear (P050 = 9)**





This volume calculation creates a piece-wise linear approximation of the level/volume curve. This option provides best results if the curve has sharp angles joining relatively linear sections.

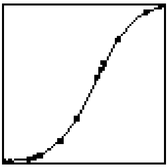
Enter a Level Breakpoint at each point where the level/volume curve bends sharply (2 minimum).

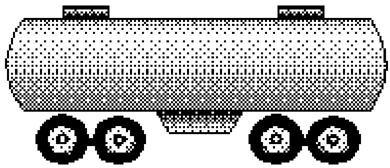
For combination curves (mostly linear but include 1 or more arcs), enter numerous breakpoints along the arc, for best volume calculation accuracy.

See also: *Checking Volume Characterization* on page 118.

## Universal, Curved (P050 = 10)

This calculation creates a cubic spline approximation of the level/volume curve, providing best results if the curve is non-linear, and there are no sharp angles.





**Select at least enough breakpoints from the curve to satisfy the following:**

- 2 breakpoints very near the minimum level
- 1 breakpoint at the tangent points of each arc
- 1 breakpoint at each arc apex
- 2 breakpoints very near the maximum level

For combination curves, enter at least 2 breakpoints immediately before and after any sharp angle (as well as 1 breakpoint exactly at the angle) on the curve.

See also: *Checking Volume Characterization* on page 118.

Appendix B

# Flow Calculation

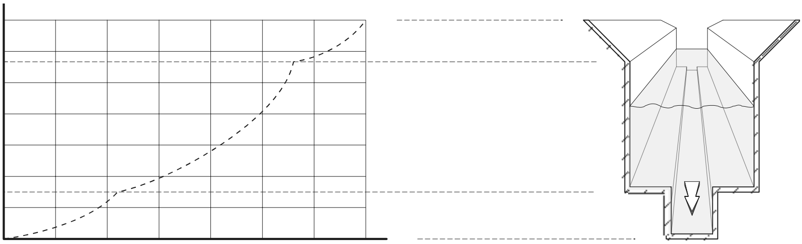
The SITRANS LUC500 provides numerous OCM flow calculation features (P600 to P612).

If the PMD (primary measuring device) does not match any of the 8 preset PMD calculations, or if a PMD is not used, select a Universal Flow calculation. Use the head/ flow graph or chart provided by the PMD fabricator (or create one based on the PMD or channel dimensions).

Based on the graph, choose the Universal Flow calculation, and select the head vs flow breakpoints to be entered (32 max). Generally, the more breakpoints entered, the greater the flow calculation accuracy.

## Universal, Linear (P600 = 4)

This flow calculation creates a piece-wise linear approximation of the head/flow curve. This option provides best results if the curve has sharp angles joining relatively linear sections.

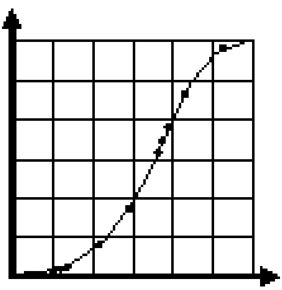


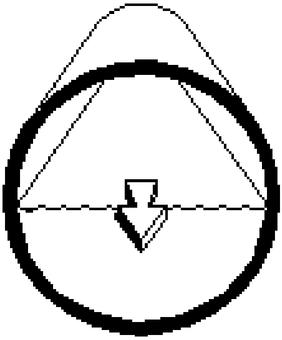
Enter a Head Breakpoint at each point where the head/flow curve bends sharply (2 minimum). For combination curves (mostly linear but include 1 or more arcs), enter numerous breakpoints along the arc, for best flow calculation accuracy.

See also: *Checking OCM Flow Characterization* on page 118.

## Universal, Curved (P600 = 5)

This calculation creates a cubic spline approximation of the head/flow curve, providing best results if the curve is non-linear, and there are no sharp angles.





**Select at least enough breakpoints from the curve to satisfy the following:**

- 2 breakpoints very near the minimum head
- 1 breakpoint at the tangent points of each arc
- 1 breakpoint at each arc apex
- 2 breakpoints very near the maximum head

For combination curves, enter at least 2 breakpoints immediately before and after any sharp angle (as well as 1 breakpoint exactly at the angle) on the curve. See also: *Checking OCM Flow Characterization* on page 118.

# Area Calculation

The universal calculations above can be applied to the Universal Area calculations (P600=10,11). If velocity is known, choose the Universal Area calculation, and select the head vs area breakpoints to be entered (32 max). Generally, the more breakpoints entered, the greater the area calculation accuracy.

# Maximum Process Speed

The SITRANS LUC500's ability to respond to material level changes is designed to exceed even the most demanding installation requirements.

The Maximum Process Speed setting automatically presets various parameters affecting the SITRANS LUC500 response to material level changes as follows:

| Parameter | Values Dependent on Maximum Process Speed (P003) | | |
|---|---|---|---|
| (units) | 1 (slow) | 2 (medium) | 3 (fast) |
| P070 Failsafe Timer (min) | 100 | 10 | 1 |
| P700 Max Fill Rate (m/min) | 0.1 | 1 | 10 |
| P701 Max Empty Rate (m/min) | 0.1 | 1 | 10 |
| P702 Filling Indicator (m/min) | 0.01 | 0.1 | 1 |
| P703 Emptying Indicator (m/min) | 0.01 | 0.1 | 1 |
| P704 Rate Filter (option) | 4 | 2 | 2 |
| P710 Fuzz Filter (% of Span) | 100 | 50 | 10 |
| P713 Echo Lock Window | (per P701 / P702 and time since last valid measurement). | | |
| P727 Scan Delay (seconds) | 5 | 5 | 3 |
| P841 Long Shot Number | 10 | 5 | 2 |

If any of these parameters are independently altered, a Maximum Process Speed (P003) parameter alteration automatically resets the independently altered value.

Slower Maximum Process Speed (P003) provides greater measurement reliability. Faster independently set Max Fill (P700) and Max Empty (P701) Rates may be impeded by Echo Lock (P711), Scan Delay (P727) and Shot Delay (P728) values.

# Appendix C–Troubleshooting

**Note:** Many of the parameters and techniques described below require extensive knowledge of ultrasonic technologies and Siemens Milltronics echo processing software. Use this information with caution.

## Common Problems Chart

| Symptom | Cause | Action |
|---|---|---|
| Display blank, transducer not pulsing. | No power. | Check power supply, wiring, or power fuse. |
| No response to programmer. | Obstructed infrared interface, defective programmer, exhausted programmer battery. | Check programmer usage:<br>15 cm (6”) from faceplate pointed at upper target<br>Or, check battery |
| Displays **Short** and **tb:(#)**. | Short circuited transducer cable, or defective transducer at indicated terminal block number. | Repair or replace as necessary. |
| Displays **Open** and **tb:(#)**. | Transducer not connected or connection reversed | Check connection to displayed terminal blocks |
| | Open circuited transducer cable, or defective transducer at indicated terminal block number. | Repair or replace as necessary. |
| Displays **LOE**. | Weak or non-existent echo. | Relocate and/or re-aim transducer at material. |
| | | Proceed to Measurement Difficulties (page 304). |
| Displays **Error** and **to:(#)**. | Transducer connected backwards. | Reverse black and white wires on terminal block. |
| | Transducer connected in **two wire** method. | Do not tie white and shield together, use all three terminal blocks. |
| | Wrong transducer selected (P004). | Verify transducer type and re-enter value. |
| Displays **EEEE**. | Value too large to display in 4 or 5 characters. | Select larger Units (P005), or lower Convert Reading (P061). |
| Reading fluctuates while material level is still, (or vice versa). | Incorrect measurement stabilization. | Alter Maximum Process Speed (P003) or damping (P704) accordingly. See Maximum Process Speed. |
| Reading is fixed, regardless of the actual material level. | Transducer acoustic beam obstructed, standpipe too narrow, or transducer ringing (reads over 100%). | Relocate and / or re-aim transducer at material level or object. |
| | | Proceed to Measurement Difficulties below. |
| | | See also: Transducer Ringing. |
| Material level reported is always OFF by the same amount. | Incorrect Empty (zero) reference for level operation (P001 = 1). | See Empty (P006), Reading Offset (P063), Offset Calibration (P650), & Offset Correction (P652). |
| Measurement accuracy improves as level nears transducer. | Incorrect Sound Velocity used for distance calculation. | Use a transducer with a built-in temperature sensor or a TS-3 temperature sensor. |
| | | See Sound Velocity. |
| Reading is erratic, with little or no relation to material level. | True echo too weak or wrong echo being processed. | Relocate and / or re-aim transducer at material. |
| | | Check noise parameters. See Noise Parameters. |
| Pump relay icon ( ) is flashing and pump does not run. | Pump has been removed from duty schedule. | Review Reporting Pump Status for discrete inputs used as pump interlocks. |

# Noise Problems

Incorrect readings can be the result of noise problems, either acoustic or electrical, in the application.

The noise present at the input to the ultrasonic receiver can be determined by viewing parameter P807. The display reads ##:##, where the first number is the average noise, and the second is the peak noise. In general, the most useful value is the average noise.

With no transducer attached the noise is under 5 dB. This is often called the noise floor. If the value with a transducer attached is greater than 5 dB, then signal processing problems can occur. High noise decreases the maximum distance that can be measured. The exact relationship between noise and maximum distance is dependent on the transducer type and the material being measured. Any noise level greater than 20 dB is probably cause for concern unless the distance is much shorter than the maximum for the transducer.

# Determine the Noise Source

Disconnect the transducer from the SITRANS LUC500. If the measured noise is below 5 dB, then continue here. If the measured noise is above 5 dB go to Non-Transducer Noise Sources on page 303.

1. Connect only the shield wire of the transducer to the SITRANS LUC500.
   If the measured noise is below 5 dB, continue with the next step. If the noise is above 5 dB, go to Common Wiring Problems on page 303
2. Connect the white and black transducer wires to the SITRANS LUC500. Record the average noise.
3. Remove the positive wire of the transducer. Record the average noise.
4. Re-connect the positive wire and remove the negative wire. Record the average noise.

Using the table below, determine the appropriate next step. The terms higher, lower and unchanged refer to the noise recorded in the previous steps.

These are guidelines only. If the suggested solution does not solve the problem, try the other options as well.

| | - removed | + removed | Go to … |
|---|---|---|---|
| noise | higher | higher | Reducing Electrical Noise |
| | higher | unchanged | Common Wiring Problems |
| | higher | lower | Reducing Acoustical Noise |
| | unchanged | higher | Reducing Electrical Noise |
| | unchanged | unchanged | Contact Siemens Milltronics |
| | unchanged | lower | Reducing Acoustical Noise |
| | lower | higher | Common Wiring Problems |
| | lower | unchanged | Common Wiring Problems |
| | lower | lower | Reducing Acoustical Noise |

### Acoustical Noise

To confirm that the problem is acoustical, place several layers of cardboard over the face of the transducer. If the noise is reduced, the noise is definitely acoustical.

## Non-Transducer Noise Sources

Remove all input and output cables from the SITRANS LUC500 individually while monitoring the noise. If removing a cable reduces the noise, that cable may be picking up noise from adjacent electrical equipment. Check that low voltage cables are not being run adjacent to high voltage cables, or near to electrical noise generators such as variable speed drives.

Filtering cables is an option but is not recommended unless all other options have been exhausted.

The SITRANS LUC500 is designed to work near heavy industrial equipment such as variable speed drives. Even so, it should not be located near high voltage wires or switch gear.

Try moving the electronics to a different location. Often moving the electronics a few meters farther from the source of noise will fix the problem. Shielding the electronics is also an option, but it should be a last resort. Proper shielding is expensive and is difficult to install properly – the shielding box must enclose the SITRANS LUC500 electronics completely, and all wires must be brought to the box through grounded metal conduit.

## Common Wiring Problems

- Make sure that the transducer shield wire is connected at the electronics end only. Do not ground it at any other location.
- Do not connect the transducer shield wire to the white wire.
- The exposed transducer shield wire must be as short as possible.
- Connections between the wire supplied with the transducer, and any customer installed extension wire should be done in grounded metal junction boxes.

On Siemens Milltronics transducers the white wire is negative and the black wire is positive. If the extension wire is colored differently, make sure that it is wired consistently.

Extension wire must be shielded twisted pair. See *Installation* section for specifications.

## Reducing Electrical Noise

- Ensure that the transducer cable does not run parallel to other cables carrying high voltage or current.
- Move the transducer cable away from noise generators such as variable speed drives.
- Put the transducer cable in grounded metal conduit.
- Filter the noise source.

## Reducing Acoustical Noise

- Move the transducer away from the noise source.
- Use a stilling well.
- Install a rubber bushing between the transducer and the mounting surface.
- Relocate or insulate the noise source.
- Change the frequency of the noise. The SITRANS LUC500 is only sensitive to noise between 25 kHz and 65 kHz.

# Measurement Difficulties

If the Failsafe Timer (P070) expires due to a measurement difficulty, **LOE** flashes alternately with the last known Reading. In rare cases, the SITRANS LUC500 may lock on to a false echo and report a fixed or wrong Reading.

# Flashing LOE Display

The loss of echo (LOE) display appears when the echo confidence is below the threshold value set in P805 Echo Confidence.

### This happens when:

- The echo is lost and no echo is shown above the ambient noise.
- Two echoes are too similar to differentiate.

### If LOE is displayed, ensure the:

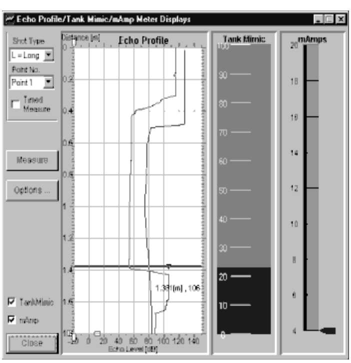
- Surface monitored is within the transducer maximum range.
- Transducer model (P004) matches the transducer used.
- Transducer is located and aimed properly.
- Transducer is not submerged without a submergence shield.

## Adjust Transducer Aiming

See the transducer manual for range, mounting, and aiming details. For optimum performance, adjust transducer aiming to provide the best Echo Confidence (P805) and Echo Strength (P806) for all material levels within the measurement range.

The most efficient method of checking echoes is with Siemens Milltronics' Dolphin Plus software.

### To display echoes




Use Dolphin Plus to graphically display the echo profile at the installation. Interpret the echo profile and change relevant parameters.

### To edit parameters…


Edit the parameter values. Use F1 to get online help at any time.

Appendix C

**To display Echo Confidence in the RUN mode…**

Press [key] and hold for 4 seconds (Failsafe Time Left changes to the Short:Long Confidence display).

To display Echo Confidence in PROGRAM mode, access the Echo Confidence (P805) parameter.

To update the value displayed after each aiming adjustment…

Press [key] (5 times or more to verify stability and overcome any echo lock P711)

## Increase Failsafe Timer Value

Increase the Failsafe Timer (P070) value, if failsafe operation will not be compromised by the larger value.

Try this only if LOE shows for short periods of time.

## Install a Transducer with a Narrower Beam

Sometimes the interference echoes from the sides of a vessel can cause the SITRANS LUC500 to lock onto a consistent, incorrect level. Try installing a longer range (narrower beam) transducer, enter the new transducer model (P004), and (if necessary) optimize aiming and frequency again.

Always contact your Siemens Milltronics service personnel before selecting a transducer to solve this type of problem.

## Use Dolphin Plus to Debug Echo

If a narrower beam transducer is not available, use Dolphin Plus to view live sonic profiles and make adjustments to the Advanced Echo Processing parameters.

If you do not own Dolphin Plus, connect an oscilloscope and use the hand programmer to adjust the same parameters.

# Fixed Reading

If the reading is a fixed value, regardless of the transducer to material surface distance, ensure the:

1. Transducer acoustic beam is free from obstruction.
2. Transducer is properly aimed
3. Transducer is not in contact with any metal object.
4. Material mixer (if used) is operating while the SITRANS LUC500 is operating. If it is stopped, ensure that the mixer blade is not stopped under the transducer.

# Obstructions in the Sound Beam

Check for (and remove if present) any acoustic beam obstruction, or relocate the transducer.

If an obstruction cannot be removed or avoided, adjust the Time Varying Threshold (TVT) Curve to reduce the Echo Confidence derived from the sound reflected by the obstruction. Use Dolphin Plus to adjust the TVT curve or use an oscilloscope and a hand programmer to adjust the required parameters. (See Scope Displays, P810 and TVT Shaper, P832).

# Standpipe Mountings

If the transducer is mounted on or in a standpipe, grind smooth any burrs or welds on the inside or open end, (the end that opens into the vessel). If the problem persists, install a larger diameter or shorter length standpipe, bevel the inside of the bottom end, or cut the open end of the standpipe at a 45° angle.

See the transducer manual for complete mounting instructions.

For ST-series and XPS-10 transducers use the plastic conduit / flange adapter supplied with the unit.

If the mounting hardware is over tightened, loosen it. Over tightening changes the resonance characteristics of the transducer and can cause problems.

# Set the SITRANS LUC500 to Ignore the Bad Echo

If the preceding remedies have not fixed the problem, the false echo has to be ignored.

### If the Echo is Close to the Transducer

If there is a static, incorrect, high level reading from the SITRANS LUC500 there is probably something reflecting a strong echo back to the transducer. If the material level never reaches that point extend the Near Blanking (P800) to a distance just past the obstruction.

### Adjust the TVT to Ignore the Echo

If increasing Near Blanking is unacceptable, the TVT Curve must be raised in the area of the false echo to ignore the false echo.

Use Dolphin Plus to view live sonic profiles and make adjustments to the TVT curve.

If you do not own Dolphin Plus, connect an oscilloscope and use the hand programmer to adjust the same parameters.

Continue making minor TVT Curve adjustments and taking new measurements while observing the Echo Marker position until the Echo Lock Window repeatedly locks onto the true echo. Verify the false echo is still ignored, regardless of the vessel material level, or empty / fill activity. Finally, ensure that the true material level can still be measured in the area where the TVT was adjusted.

# Wrong Reading

If the reading is erratic, or jumps to some incorrect value periodically, ensure the:

1. Surface monitored is not beyond the SITRANS LUC500's programmed range or the transducer's maximum range
2. Material is not falling into the transducer's acoustic beam
3. Material is not inside the blanking distance of the transducer

## Types of Wrong Readings

If a periodic wrong reading is always the same value, see Fixed Reading.

If the wrong reading is random, ensure the material surface to transducer distance is less than the Empty value entered plus 20%. If the material/object monitored is outside this distance, increase Range Extension (P801) as required. This error is most common in OCM applications using weirs.

# Liquid Splashing

If the material monitored is a liquid, check for splashing in the vessel. Enter a lower Maximum Process Speed (P003) value to stabilize the Reading, or install a stilling well. (Contact Siemens Milltronics or your local distributor).

# Adjust the Echo Algorithm

Use Dolphin Plus to view live sonic profiles and make adjustments to the P820 Algorithm parameter. See the Parameter Reference section for details.

If you do not own Dolphin Plus, connect an oscilloscope and use the hand programmer to adjust the same parameter.

If the **Area** algorithm is used and narrow noise spikes are evident on the (long shot) Echo Profile, turn the Spike Filter (P821) on and/or widen the Narrow Echo Filter (P822). Also, if the true echo has jagged peaks, use Reform Echo (P823).

If multiple echoes appear on the Echo Profile, typical of a flat material profile (especially if the vessel top is domed), use the **first** Algorithm.

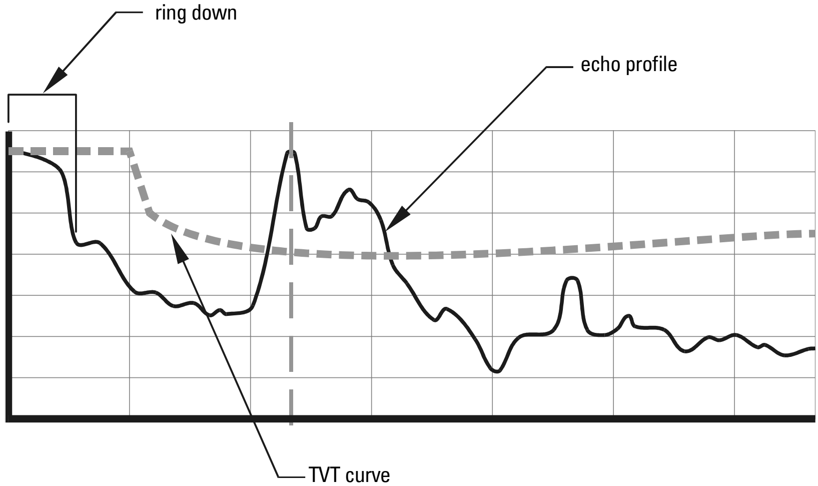
If the Echo Profile repeatedly switches from short to long, adjust the Short Shot Range (P852) to stabilize the **shot** mode used for the echo evaluation. Also, adjust the Short Shot Bias to increase (or decrease the amount of preference given to short shot echoes over long shot echoes.

Should a stable measurement still not be attainable, contact Siemens Milltronics or your local distributor.

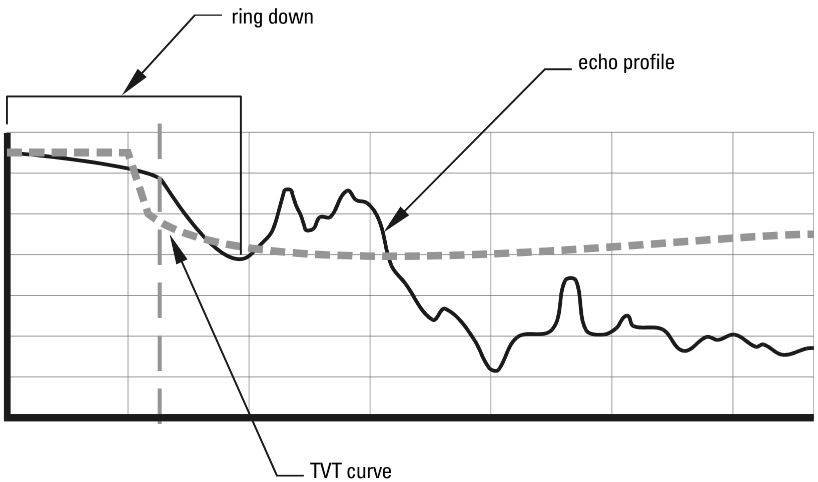
# Transducer Ringing

If the transducer is mounted too tightly, or if it is mounted so that its side touches something, its resonance characteristics change and this can cause problems.

### Normal Ring Down




### Poor Ring Down




Ring down times that extend past the near blanking area can be interpreted by the SITRANS LUC500 as the material level and are characterized by a steady high level being reported.

# Appendix D–Pump Control Reference

The SITRANS LUC500 has the pump control strategies to solve nearly any water / wastewater application. This section details these strategies for engineers requiring in-depth knowledge of the system and how it operates.

## Pump Control Options

Methods of pump control are dependent on two variables:

**Pump Duty** indicates in what sequence pumps are started.

**Pump Start Method** indicates whether new pumps start and run with any currently running pumps (most common) or whether new pumps start and shut off currently running pumps.

### Pump Availability

The way pumps are affected by interlocks depends on a number of parameters, mostly in the P500 series [see Pump Interlock Allocation (P500 to P509) on page 233]. They can be local or remote meaning that commands to run can come from the SITRANS LUC500 itself or an external system through one of the communication ports. They can be auto or manual meaning that commands to run can come from SITRANS LUC500's pump control algorithms or from a manual / local switch.

### Pump Groups

The SITRANS LUC500 groups pumps that use identical pumping strategies based on the value of P111–Relay Control Function. Generally, one group of pumps corresponds to one wet well or reservoir.

### Pump by Rate

To trigger pump starts by the rate of change in material level use P121–Pump by Rate. New pumps are started, one at a time, until the rate setpoint (P702–Filling Indicator, or P703–Emptying Indicator) is reached.

## Discrete Inputs

Some pumps can tell the SITRANS LUC500 through contacts that they are running (confirmation) or experiencing a fault.

Pumps can be removed from the rotation if they are not pumping efficiently or they are reporting a failure. Failures are reported using the SITRANS LUC500's discrete inputs.

To configure the SITRANS LUC500 to pull a pump out of the rotation based on the discrete input:

1. Wire the discrete inputs for the pumps to the appropriate terminals on the terminal block (see *Installation* section for terminal block information).
2. Configure the discrete input functions (see page 53).
3. Configure the Pump Interlock Allocation (P500 to P509).
4. Test the setup (see Testing the Configuration on page 117).

## Pump Failure

When a pump fails it is automatically taken out of service. To put the pump back into service an operator must go to the location and manually set P510 back to **0** from **1**, or a SCADA system must be in place to reset the pump control bits. See *Communications* section for details on the Modbus register to use. A reset push-button wired to a discrete input and programmed with P509 allows pump faults to be reset.

## Auto / Manual

A pump can be controlled based on an **Auto / Manual** switch connected to a discrete input. The pump is returned to SITRANS LUC500 control as soon as the switch is set back to **auto**. This ability is also available through communications so that a remote system can control a pump directly.

# Pump Control Algorithms

All of these algorithms can be used to start multiple pumps (assist) or one pump at a time (backup). The SITRANS LUC500 has three main methods of pump control:

**Fixed:** Starts pumps based on individual setpoints and always starts the same pumps in the same sequence.

**Alternate:** Starts pumps based on the duty schedule and always leads with a new pump.

**Service Ratio:** Starts pumps based on user-defined ratio of running time.

## Fixed Duty Assist (P111 = 50)

*Ties the indexed pump relay directly to the indexed setpoint.*

### Relay Operation (for P118 = 2)

The relay contact closes at the **ON** setpoint and opens at the **OFF** setpoint. Multiple relay contacts in the pump group can be closed at the same time.

### Relay Table

The following table shows relay status when each setpoint is reached.

| | | Relays | | |
|---|---|---|---|---|
| Setpoints | index | 1 | 2 | 3 |
| | on 3 | On | On | On |
| | on 2 | On | On | Off |
| | on 1 | On | Off | Off |
| | off 0 | Off | Off | Off |

## Fixed Duty Backup (P111 = 51)

*Ties the indexed pump relay directly to the indexed setpoint.*

### Relay Operation (for P118 = 2)

The relay contact closes at the **ON** setpoint and opens at the **OFF** setpoint. When a new relay trips the previously closed relay contact opens to shut down the running pump.

Only one relay contact in the pump group can be closed at any one time.

### Relay Table

The following table shows relay status when each setpoint is reached.

| | | Relays | | |
|---|---|---|---|---|
| Setpoints | index | 1 | 2 | 3 |
| | on 3 | Off | Off | On |
| | on 2 | Off | On | Off |
| | on 1 | On | Off | Off |
| | off 0 | Off | Off | Off |

## Alternate Duty Assist (P111 = 52)

*Alternates the lead pump each time the material level cycles and runs all pumps together.*

### Relay Operation (for P118 = 2)

The setpoints associated with the relays are grouped so that they can be rotated.

Setpoint one does not relate directly to relay one. The pumping algorithm manages the mapping of setpoints to relays.

When pumps are run, they run in parallel.

### Relay Table

| Cycle 1 | | Relays | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Setpoints | on 3 | On | On | On |
| | on 2 | On | On | Off |
| | on 1 | On | Off | Off |
| | off 0 | Off | Off | Off |
| **Cycle 2** | | **Relays** | | |
| | | 1 | 2 | 3 |
| Setpoints | on 3 | On | On | On |
| | on 2 | Off | On | On |
| | on 1 | Off | On | Off |
| | off 0 | Off | Off | Off |
| **Cycle 3** | | **Relays** | | |
| | | 1 | 2 | 3 |
| Setpoints | on 3 | On | On | On |
| | on 2 | On | Off | On |
| | on 1 | Off | Off | On |
| | off 0 | Off | Off | Off |

# Alternate Duty Backup (P111 = 53)

*Alternates the lead pump each time the material level cycles.*

### Relay Operation (for P118 = 2)

The setpoints associated with the relays are grouped so that they can be rotated. Setpoint one does not relate directly to relay one. The pumping algorithm manages the mapping of setpoints to relays. When pumps are run, they can run only one at a time.

### Relay Table

| Cycle 1 | | Relays | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Setpoints | on 3 | Off | Off | On |
| | on 2 | Off | On | Off |
| | on 1 | On | Off | Off |
| | off 0 | Off | Off | Off |
| **Cycle 2** | | **Relays** | | |
| | | 1 | 2 | 3 |
| Setpoints | on 3 | On | Off | Off |
| | on 2 | Off | Off | On |
| | on 1 | Off | On | Off |
| | off 0 | Off | Off | Off |
| **Cycle 3** | | **Relays** | | |
| | | 1 | 2 | 3 |
| Setpoints | on 3 | Off | On | Off |
| | on 2 | On | Off | Off |
| | on 1 | Off | Off | On |
| | off 0 | Off | Off | Off |

# Service Ratio Duty Assist (P111 = 54)

*Selects the lead pump based on number of hours each pump has run and the specified ratios that each pump requires. Multiple pumps can run at one time.*

## Relay Operation (for P118 = 2)

The setpoints associated with the relays are grouped so they can be redistributed based on pump run time ratios. The next pump to start or stop is the one with the required time to actual time ratio.

Over time the number of hours demanded of each pump will conform to the ratios specified. Usually, the ratios are specified in percent values.

To create a grouping of pumps where two pumps make up 50% of the run time and the third pump makes up the other 50%, P122 is set to these values:

| P122 index | value |
|---|---|
| 1 | 25 |
| 2 | 25 |
| 3 | 50 |

## Service Ratio Duty Backup (P111 = 55)

*Selects the lead pump based on number of hours each pump has run and the specified ratios that each pump requires. Only one pump can run at a time.*

This algorithm is the same as Service Ratio Duty Assist except that it will only run one pump at a time. When the next pump in the sequence starts, the previous pump stops.

## First In First Out (FIFO) (P111 = 56)

*Selects the lead pump based on the ALTERNATE duty but uses staggered off setpoints and shuts down pumps based on the first in, first out rule.*

This algorithm starts pumps in the same way as Alternate Duty Assist but uses staggered OFF setpoints to shut the pumps down. When the first OFF setpoint is reached the FIFO rule shuts down the first pump started. If the pumps started in sequence 2,3,1 then they would be shut down in sequence 2,3,1.

## Pump by Rate (P121)

*Starts pumps until the level is changing at the rate specified in P702 or P703.*

Pumping costs can be less because only the highest ON setpoint needs to be programmed and this results in a lower difference in head to the next wet well which, in turn, results in less energy being used to pump out the well.

# Other Pump Controls

There are a number of other controls available to modify pump behaviour.

### Pump Run-on (P130, P131)

Extends the run period for a pump based on the number of pump starts. This allows for the wet well to be pumped lower than usual and reduces sludge build-up on the well bottom.

### Pump Exercising (P134)

Runs idle pumps and reduces the chance of seizing.

### Wall Cling Reduction (P136)

Varies the ON and OFF setpoints to keep a fat ring from forming around the walls of the wet well.

### Pump Group (P137)

Allows for two different Alternate Duty Assist or Alternate Duty Backup pump groups in the same application.

### Energy Savings (P140 to P145)

Modifies pump setpoints based on the time of day to minimize head and run time (and subsequent cost) during high cost periods.

### Overflow / Underflow (P165)

Takes special action (open valve, stop pumps, start all pumps) when a 3Hi alarm (overflow) occurs. This can also be used as a 3Lo alarm (underflow).

### Flush Device (P170 to P173)

Operates a flush valve or special flush device based on the number of pump starts, usually to aerate wet well wastewater.

### Pump Algorithm Override by Contact Device

Use parameters P558 and P559 to set up contact devices (floats for example) as a back-up to override the pump control algorithms set in P111 to P113. Contact devices can be wired to the SITRANS LUC500 discrete inputs, and programmed to control pumps via parameters P558 (Pump Start, Discrete Input) and P559 (Pump Stop, Discrete Input).

# Appendix E–Updating Software



The SITRANS LUC500 can be updated in the field with new code and features.

## Updating Software

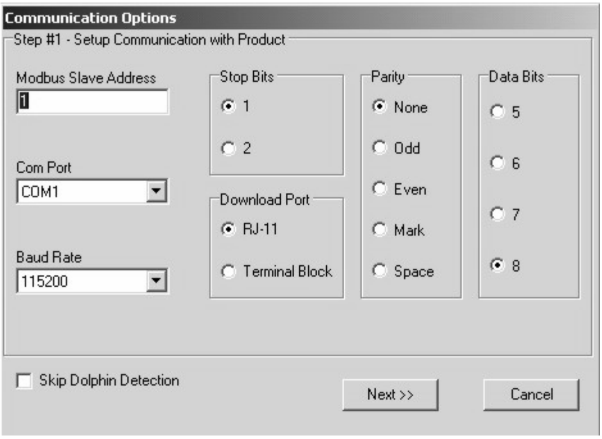
**WARNING: All parameter values will be lost during software upgrade. Record your current parameters manually or using Dolphin Plus before upgrade.**

If the software upgrade file has a .exe extension, follow the Software Upgrade Utility instructions below. If the upgrade file has a .hex extension, upgrade using Dolphin Plus.

### Software Upgrade Utility

Use the new Siemens Milltronics Software Upgrade Utility to upgrade to the latest software revision using an RJ-11 to DB-9 communication cable. Contact your local Siemens Milltronics representative to obtain the software. For a complete list of representatives, go to **www.siemens.com/processautomation**.

1. Connect your PC or laptop to the SITRANS LUC500's RJ-11 port using an RJ-11 to DB-9 cable (used for Dolphin Plus).
2. Run the .exe upgrade utility program in the software. Select **Begin**.
3. Use the upgrade utility to set the RS-232 settings to match your SITRANS LUC500. The software default settings will already match the default settings of the SITRANS LUC500. Only alter settings when the RS-232 settings in the SITRANS LUC500 have been changed. Select **Next ->** and then **Start**.




4. Verify that the upgrade utility confirms a successfully upgrade before exiting.
5. Complete a Master Reset (P999) after a successful upgrade, before re-entering parameters.

## Dolphin Plus

To update the software in the SITRANS LUC500 using a .hex file, follow these steps.

1. Get a new software file from your Siemens Milltronics representative and copy the .hex file onto the hard disk of the computer
2. Run Dolphin Plus
3. Select **File** and then **Download flash ROM from file to instrument…**

# Enabling New Functions

It is possible to upgrade the current software in your SITRANS LUC500 unit in order to enhance its performance. Several optional features currently exist in the non-volatile memory of the SITRANS LUC500 unit, and can be enabled using Access Codes purchased from Siemens Milltronics.

**The following items are currently available as Optional Features:**

- Dual Point
- Data Logging

This feature requires an optional memory card.

- Auxiliary I/O Cards

This feature requires additional Hardware that is purchased separately.

**Note:** You may need to update your software before enabling new features.

## Step 1. Get Access Code

Before you can enable a new feature on the SITRANS LUC500 you need to get an access code from Siemens Milltronics. This access code is unique to the SITRANS LUC500 and keyed off of the serial number.

When calling Siemens Milltronics for the access code have the following information ready:

- The values from parameters 345 and 346
- Option(s) that you want to enable

## Identification Codes

The method of determining the identification codes depends on the software revision of your SITRANS LUC500. The software revision is stored in P900. Check this value before continuing.

**If P900 is 3.00 or higher …**

The identification codes are shown in these parameters:

| Parameter | Value |
|---|---|
| P345 | date portion of identification code |
| P346 | numeric portion of identification code |

Proceed to Step 2 below.

#### If P900 is less than 3.00…

You must upgrade the software because your software is not capable of handling the optional features.

Contact Siemens Milltronics for a software upgrade, and install it using the instructions at the beginning of this chapter.

#### Once the software is upgraded…

The identification code is made up of two parts of the serial number shown in parameters 345 and 346. P345 is view only, so you cannot change it, but you must scroll to parameter P346 and enter the numeric portion of the unit's serial number.

The complete serial number is printed on the side of the unit, and is comprised of 9 digits followed by 2 letters. The first 6 digits are a date, and the remaining 3 are the numeric portion. It is important that you find the number that ends with either "SC" or "RY," there may be other numbers on the unit that end with other codes – these are not the unit's serial number.

Example: The serial number **020400101SC** breaks down as follows:

| Parameter | Value | Description |
|---|---|---|
| P346 | 101 | numeric portion of identification code |
| P345 | 020400 | date portion of identification code |

In this example, the user would enter **101** into P346.

## Step 2. Enter Access Code

| Parameter | Value |
|---|---|
| P738 | access code provided by Siemens Milltronics |

The access code is a long sequence of numbers. Type the numbers in with the hand programmer or Dolphin Plus. When using the hand programmer they will scroll off the left of the reading field, this is normal.

If you make an error when entering the number, press C and enter the number again.

Press Enter and the parameter reverts to **0** to indicate that the code was accepted.

**Error** shows on the LCD if the code was not accepted. Ensure that you typed the code correctly. If you still have problems contact your Siemens Milltronics representative.

## Step 3. Cycle the Instrument (power or P902)

To start using the new functionality of the SITRANS LUC500 you must restart it.

You can do this by either cycling the power or using the watchdog test parameter, P902.

To use P902, display that parameter and press ↵. In ten seconds the unit will restart and the new functions will be ready to program.

See Optional Features on page 38 for information on how optional functions affect the examples in this manual and the indexing of parameters in general.

## Step 4. Reset the Instrument (P999)

Perform a **P999** to reset all parameters and reconfigure the unit. This can be done using the hand programmer or Dolphin Plus. If you have the dual point option enabled, ensure you perform the P999 against both points (index value 00).

# Installing Hardware with Software

Some optional features require additional hardware to operate (for example, the data logging feature uses an additional memory card). This hardware does not need to be installed immediately when the Access Code that enables the feature is entered. To activate the feature on a unit in which the Access code has already been installed, power down the unit, install the hardware, and power it up again. The feature will now be available.

# Removing Features

Once added, a feature cannot be removed.

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**www.siemens.com/processautomation**

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7ML19985GL01
Printed in Canada

**Rev. 1.1**