Instruction Manual · September 2003

milltronics

SF 500

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.

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

Note: Always use product in accordance with specifications.

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Milltronics SF 500

Note: The Milltronics SF 500 is to be used only in the manner outlined in this instruction manual.

The Milltronics SF 500 is a full-feature integrator for use with solids flowmeters. The SF 500 processes the signal from the flowmeter and calculates values for the rate of material flow and totalization. These values are displayed on the local LCD, or output in the form of analog mA, alarm relay, or remote totalization.

Milltronics SF 500 features

The SF 500 is programmable

- Two remote totalizer contacts
- Five programmable relays
- Five programmable discrete inputs
- One programmable isolated mA output for rate (standard)
- Two programmable isolated mA input, for PID control
- Two programmable isolated mA output for rate, PID control, or on-line calibration

The SF 500 is flexible

- Rate linearization
- Auto zero
- PID* control
- Batch control
- Multispan operation
- On-line calibration

* PID and on-line calibration control requires the optional mA I/O board.

The SF 500 can communicate

There are three communication ports on the SF 500, as standard. Use the two RS-232 ports for Milltronics Dolphin Plus and Modbus protocol. Link the RS-485 port to either a PLC or a computer. The SF 500 also supports Siemens Milltronics SmartLinx® and networks with popular industrial communication systems.

The SF 500 is upgradeable

Enhance its basic features with the following:

- mA I/O board
- SmartLinx module

The Manual

It is essential that this manual be referred to for proper installation and operation of your SF 500 solids flowmeter integrator. As the SF 500 must be connected to a solids flowmeter, refer to the flowmeter's manual as well.

The manual is designed to help you get the most out of your SF 500, and it provides information on the following:

- How to install the unit
- How to program the unit
- How to operate the keypad and read the display
- How to do an initial Start Up
- How to optimize and maintain accurate operation of the unit
- Outline diagrams
- Wiring diagrams
- Parameter values
- Parameter uses
- Modbus register mapping
- Modem configuration

If you have any questions, comments, or suggestions about the manual contents, please email us at techpubs@siemens-milltronics.com.

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Specifications

Power

- 100/115/200/230 V ac ±15%, 50/60 Hz, 31 VA
- fuse, FU1 2AG, Slo Blo, 2 A, 250 V or equivalent

Application

- compatible with Siemens Milltronics solids flowmeters or equivalent 1 or 2 load cell flowmeters
- compatible with LVDT equipped solids flowmeters, with use of optional interface board

Accuracy

- 0.1% of full scale

Resolution

- 0.02% of full scale

Environmental

- location: indoor / outdoor
- altitude: 2000 m max
- ambient temperature: -20 to 50°C (-5 to 122°F)
- relative humidity: suitable for outdoor (Type 4X / NEMA 4X /IP65 enclosure)
- Installation category: II
- pollution degree: 4

Enclosure

- Type 4X / NEMA 4X / IP65
- 285 mm W x 209 mm H x 92 mm D (11.2" W x 8.2" H x 3.6" D)
- polycarbonate

Programming

- via local keypad and/or Dolphin Plus interface

Display

- illuminated 5 x 7 dot matrix liquid crystal display with 2 lines of 40 characters each

Memory

- program stored in non-volatile FLASH ROM, upgradable via Dolphin Plus interface
- parameters stored in battery backed RAM. The battery is 3V NEDA 5003LC or equivalent, nominal 5 year life

Inputs

- load cell/LVDT Conditioning Card: 0 - 45 mV dc per load cell/LVDT Conditioning Card
- auto zero: dry contact from external device
- mA see optional mA I/O board
- auxiliary: 5 discrete inputs for external contacts, each programmable for either display scrolling, totalizer 1 reset, zero, span, multispan, print, batch reset, or PID function.

Outputs

- mA:
  - 1 programmable 0/4 - 20 mA, for rate, for rate output
  - optically isolated
  - 0.1% of 20 mA resolution
  - 750 Ω load max
  - see optional mA I/O board
- load cell/LVDT Conditioning Card: 10 Vdc compensated excitation for LVDT Conditioning Card or strain gauge type load cells, 2 cells max, 150 mA max
- remote totalizer 1:
  - contact closure 10 - 300 ms duration
  - open collector switch rated 30 Vdc, 100 mA max
- remote totalizer 2:
  - contact closure 10 - 300 ms duration
  - open collector switch rated 240 Vac/dc, 100 mA max
- relay output: 5 alarm/control relays, 1 form 'A' SPST relay contact per relay, rated 5 A at 250 Vac, non-inductive

Communications

- two RS-232 ports
- one RS-485 port
- SmartLinx® compatible (see *Options* on page 5)

Cable

- one load cell/LVDT:
  - non-sensing: Belden 8404, 4 wire shielded, 20 AWG or equivalent, 150 m (500 ft.) max
  - sensing: Belden 9260, 6 wire shielded, 20 AWG or equivalent, 300 m (1000 ft.) max
- two load cells:
  - non-sensing: Belden 9260, 6 wire shielded, 20 AWG or equivalent 150 m (500 ft.) max
  - sensing: Belden 8418, 8 wire shielded, 20 AWG or equivalent, 300 m (1000 ft.) max

- auto zero: Belden 8760, 1 pair, twisted/shielded, 18 AWG, 300 m (1000 ft.) max
- remote total: Belden 8760, 1 pair, twisted/shielded, 18 AWG, 300 m (1000 ft.) max

Options

- Dolphin Plus: Siemens Milltronics Windows® based software interface (refer to associated product documentation)
- SmartLinx® Modules: protocol specific modules for interface with popular industrial communications systems (refer to associated product documentation)
- mA I/O board:
  - inputs: - 2 programmable 0/4 – 20 mA for PID, control optically isolated
    - 0.1% of 20 mA resolution
    - 200 Ω input impedance
  - outputs: - 2 programmable 0/4 – 20 mA for PID control or rate
    - optically isolated
    - 0.1% of 20 mA resolution
    - 750 Ω load max
- output supply: unregulated, isolated 24 Vdc at 50 mA, short circuit protected
- LVDT interface card: for interface with LVDT solids flowmeters (separately mounted)

Weight

- 2.6 kg (5.7 lbs.)

Approvals

- CE*, CSA $_{NRTL/C}$

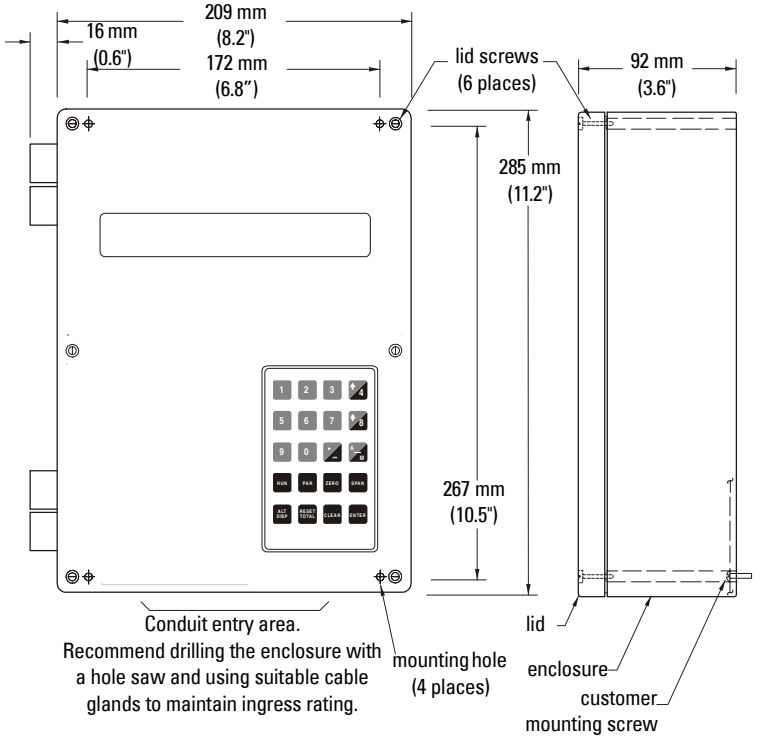
*EMC performance available upon request.

Installation

Notes:

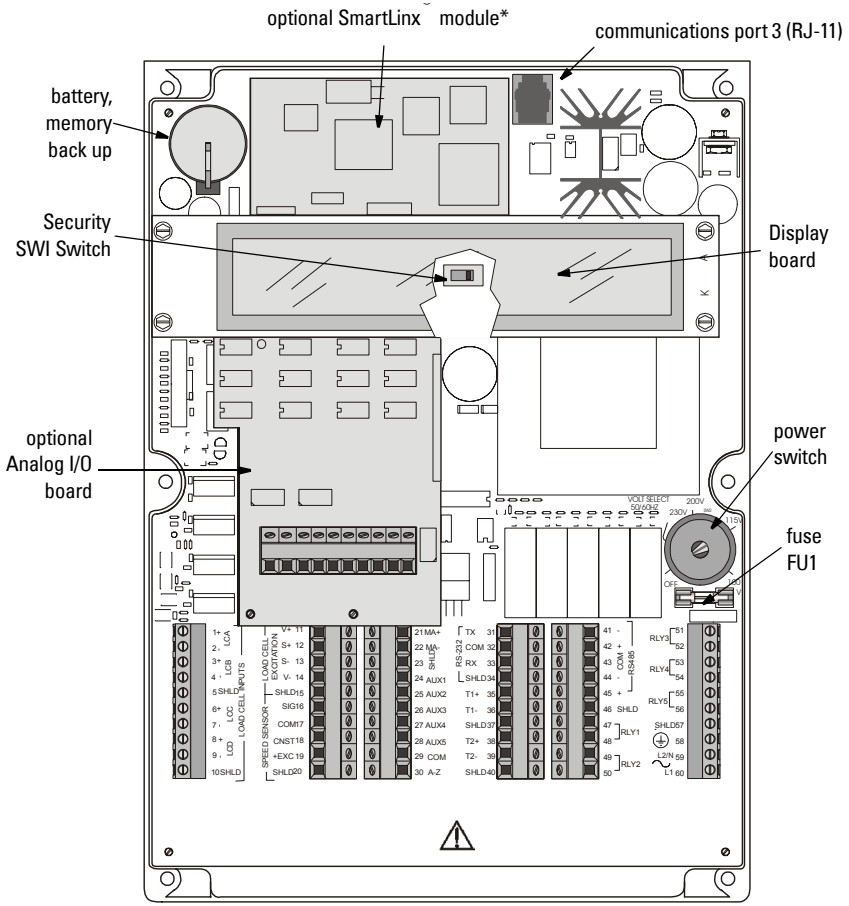
- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- This product is susceptible to electrostatic shock. Follow proper grounding procedures.

Dimensions



Note: Non-metallic enclosure does not provide grounding between connections. Use grounding type bushings and jumpers.

Layout



*To reduce communication interference, route SmartLinx® cable along right side of enclosure wall.

Notes:

- Installation shall only be performed by qualified personnel and in accordance with local governing regulations.
- The Security Switch is shown in its normal position (to the right). When it is in the left position it locks out most keypad functions. See *P350 Calibration Security* on page 103.

WARNING:

- All field wiring must have insulation suitable for at least 250 V.
- Supply dc terminals from SELV source in accordance with IEC 10101-1 Annex H.
- Relay contact terminals are for use with equipment having no accessible live parts and wiring having insulation suitable for at least 250 V.
- The maximum allowable working voltage between adjacent relay contact shall be 250 V.

Software Updates

Note: Contact a Siemens Milltronics representative and get the latest software revision before upgrading the software in the SF 500.

To update the software you will need:

- Siemens Milltronics Dolphin Plus
- Serial cable to connect a computer and the SF 500
- Software update file

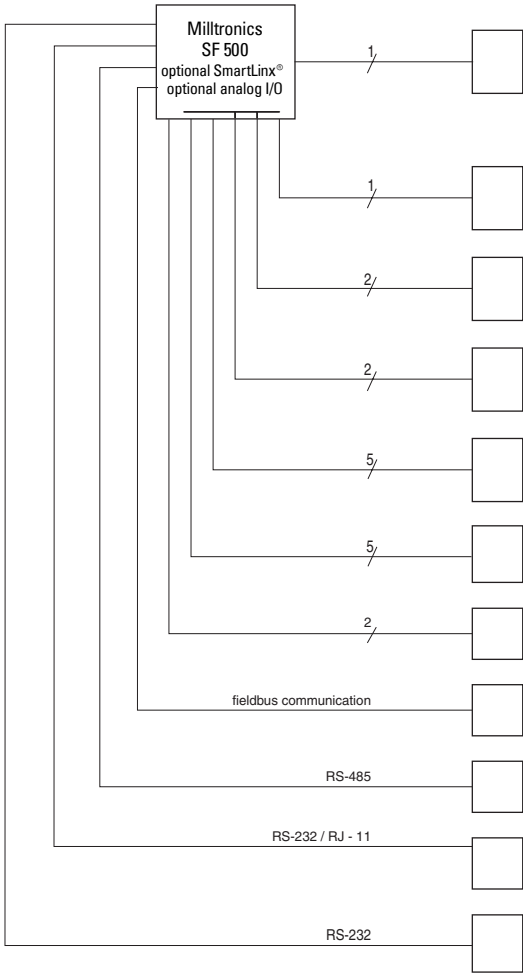
To update the software, follow this procedure:

1. Save the old software to your PC
2. Save the existing parameters to your PC - you may want to print them off for added security
3. Load the new software into the SF 500
4. Perform a master reset (P999)
5. Load the parameters from the file you created in step 2 - alternatively, re-enter them from the parameter print out

When downloading parameters with Dolphin Plus, make sure that the SF 500 is in PROGRAM mode. The zero and span values are included in the parameter file but you should perform new zero and span calibrations to ensure operating accuracy.

Interconnection

System Diagram



Solids flowmeter, See *Specifications,* page 3

mA output to customer device

mA output to customer device

mA input from customer device

relay output, to customer device

auxiliary inputs

customer remote totalizer

optional fieldbus connection

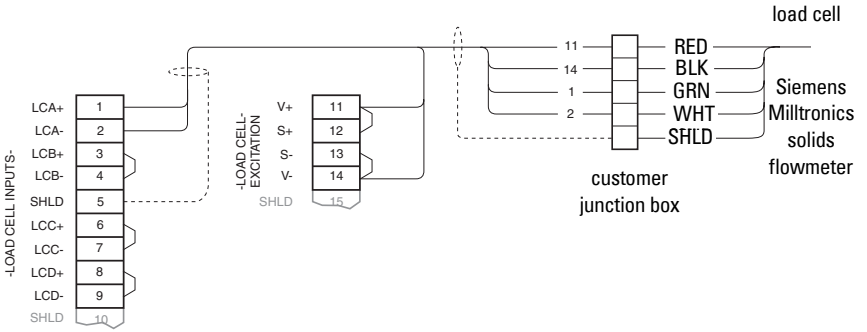
communication ports can be configured for Siemens Milltronics Dolphin, print data, or Modbus ASCII or RTU protocol

Note:

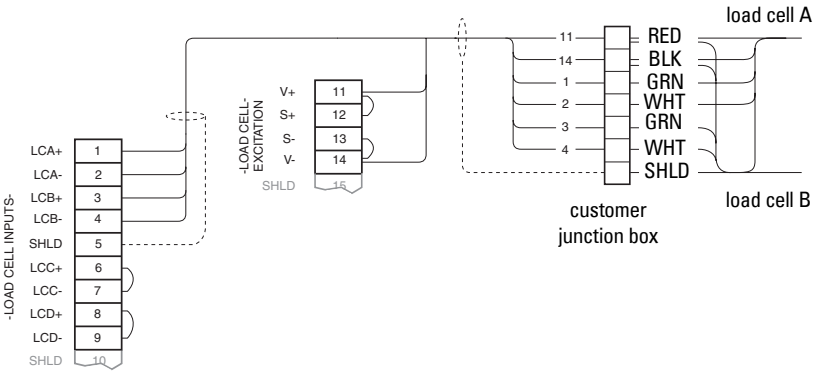
- Run wiring via a common conduit
- Do not run wiring in the same conduit as the high voltage contact or power wiring
- Ground shield at one point only. Insulate at junctions to prevent inadvertent grounding.
- Typical system capability. Not all components or their maximum quantity may be required.

Flowmeter

One Load Cell



Two Load Cell



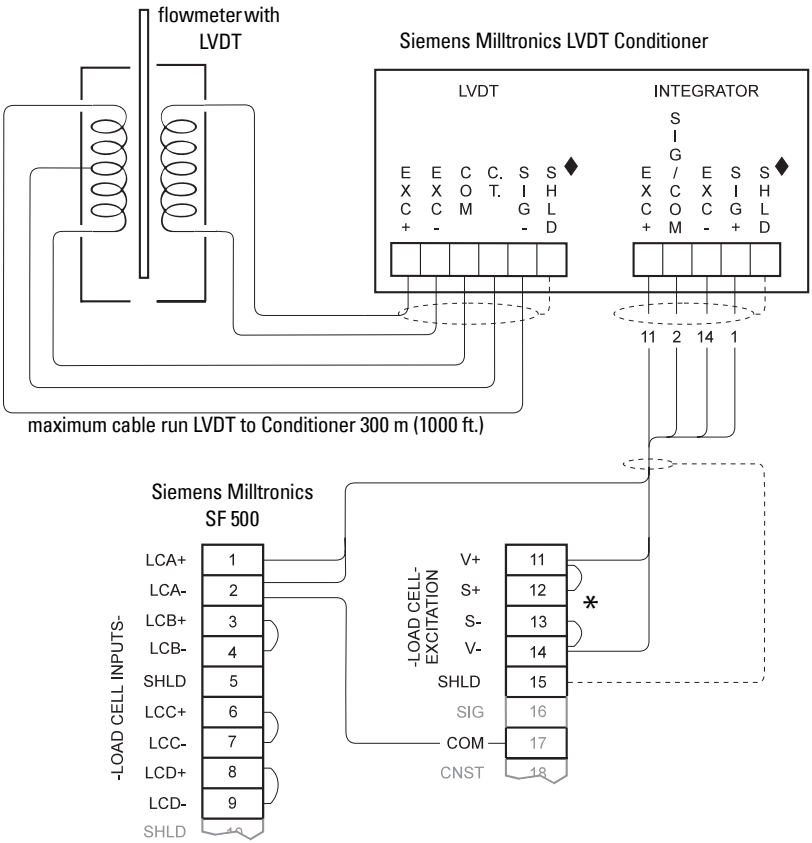
Where separation between the SF 500 and flowmeter exceeds 150 m (500 ft.):

1. remove the jumpers from SF 500 terminal 11/12 and 13/14
2. run additional conductors from:
   SF 500 terminal 12 to scale RED
   SF 500 terminal 13 to scale BLK

If the load cell wiring colours vary from those shown, or if extra wires are provided, consult Siemens Milltronics.

LVDT

	EXC+	EXC-	COM	C.T.	SIG-
Standard	Red	Blue	Yellow	Black	Green
Encapsulated	Red	Orange	White	Black	Yellow



♦ Shields are common, but not grounded to chassis. Run cable shields through SHLD terminals and ground at SF 500 only.

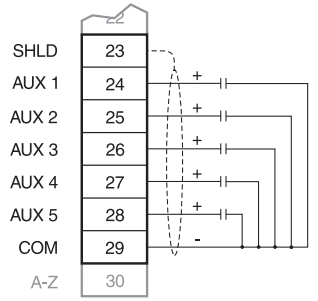
If separation between the SF 500 and LVDT conditioner exceeds 150 m (500 ft.):

1. remove the jumpers from SF 500 terminal 11/12 and 13/14
2. run additional conductors from:
   SF 500 terminal 12 to integrator terminal block '+EXC'
   SF 500 terminal 13 to integrator terminal block '-EXC'

For further connection information on specific LVDTs consult Siemens Milltronics.

Note: A common error is missing the connection from SF 500 terminal 2 to SF 500 terminal 17.

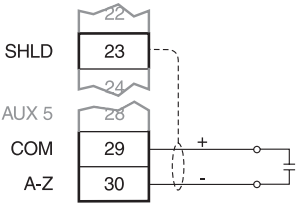
Auxiliary Inputs



Customer dry contacts, or open collector transistor output supplied as required

Refer to *P270* on page 100 for programming details.

Auto Zero

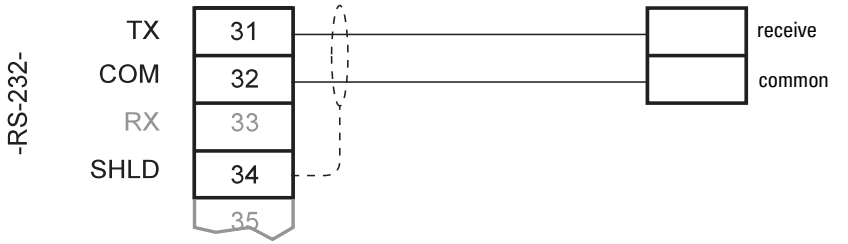


Prefeed activated dry contact

Refer to *Auto Zero* on page 35.

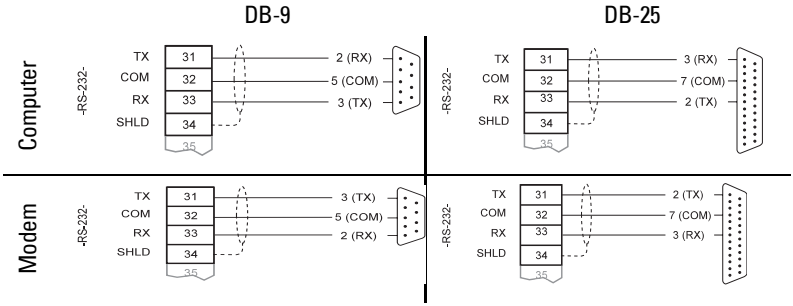
RS-232 (Port 1)

Printers



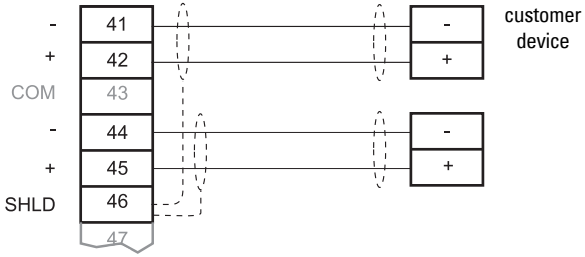
Computers and Modems

Typical configurations for connection to a PC compatible computer or modem, using no flow control:

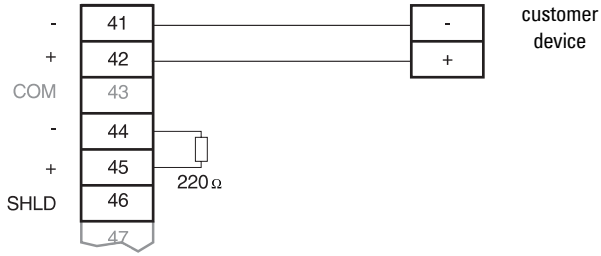


RS-485 (Port 2)

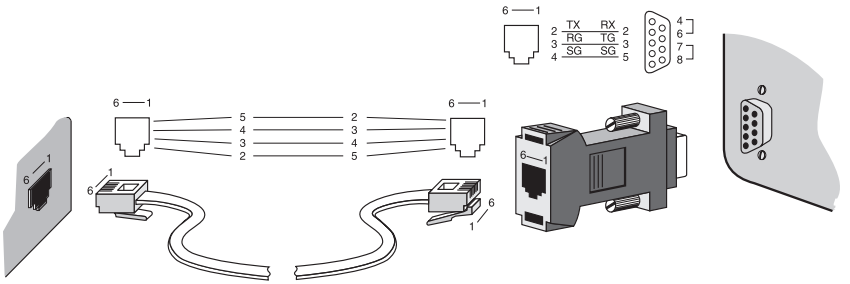
Daisy Chain



Terminal Device

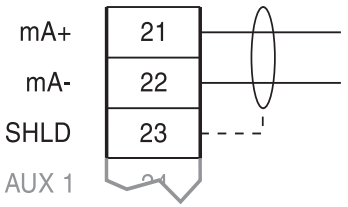


RS-232 (Port 3)



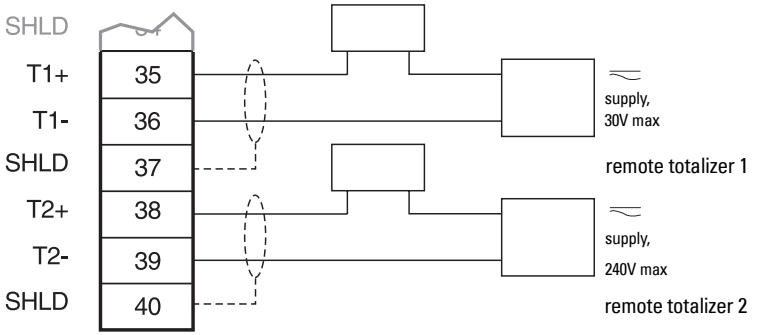
Note: Jumper pins 4-6 and 7-8 when using hardware flow control. Otherwise, leave them open.

mA Output 1



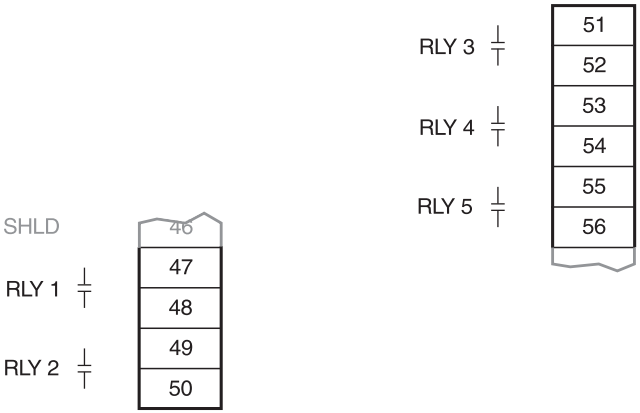
to customer instrumentation, isolated mA output, 750 Ω maximum load

Remote Totalizer



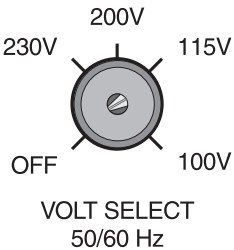
Installation

Relay Output



The relays are shown in de-energized state. Contacts are normally open, rated 5 A at 250V non-inductive.

Power Connections



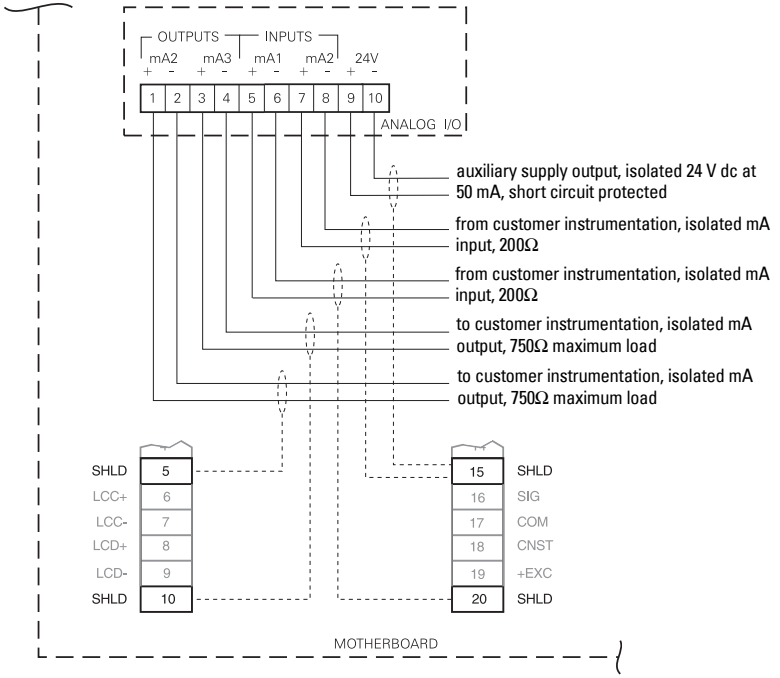
VOLT SELECT
50/60 Hz

Notes:

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

100 / 115 / 200 / 230V
50 / 60 Hz
select voltage via switch

mA I/O Board



Installing/Replacing the Memory Back-up Battery

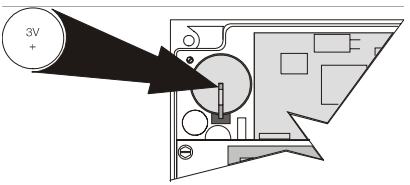
The memory battery (3V NEDA 5003LC) has a life expectancy of 10 years. Battery life may be less in cooler climates. In the event that the SF 500 loses external and battery power, a capacitor powers the RAM for approximately 5 minutes.

The SF 500 requires no maintenance or cleaning, other than a periodic replacement of the memory backup battery.

Notes:

- Do not install the memory backup battery until the SF 500 is installed, as it begins operation immediately.
- The unit is supplied with one battery. Insert it into the holder as shown below.

Disconnect power before installing or replacing the battery.



Installation Steps

1. Open the enclosure lid.
2. Slide the battery into the holder. Be sure to align the + and – terminals correctly.
3. Close and secure enclosure lid.

Installing Optional Plug-in Boards

You can order the following optional plug-ins from Siemens Milltronics:

SmartLinx module

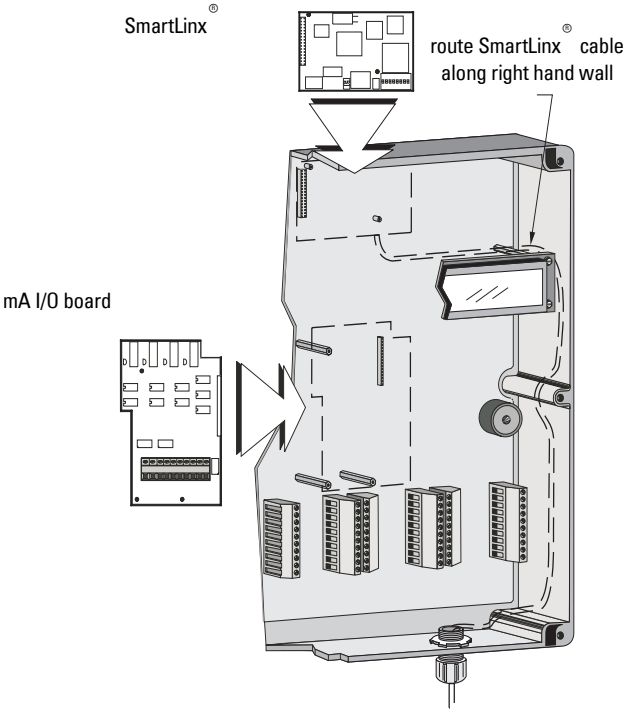
Enhances the existing SF 500 Communications System by providing an interface in one of several popular industrial communications standards.

Analog Input / Output board

The mA I/O board provides 2 programmable 0/4-20 mA outputs, 2 programmable 0/4-20 mA inputs and a nominal 24V dc supply for loop-powered devices.

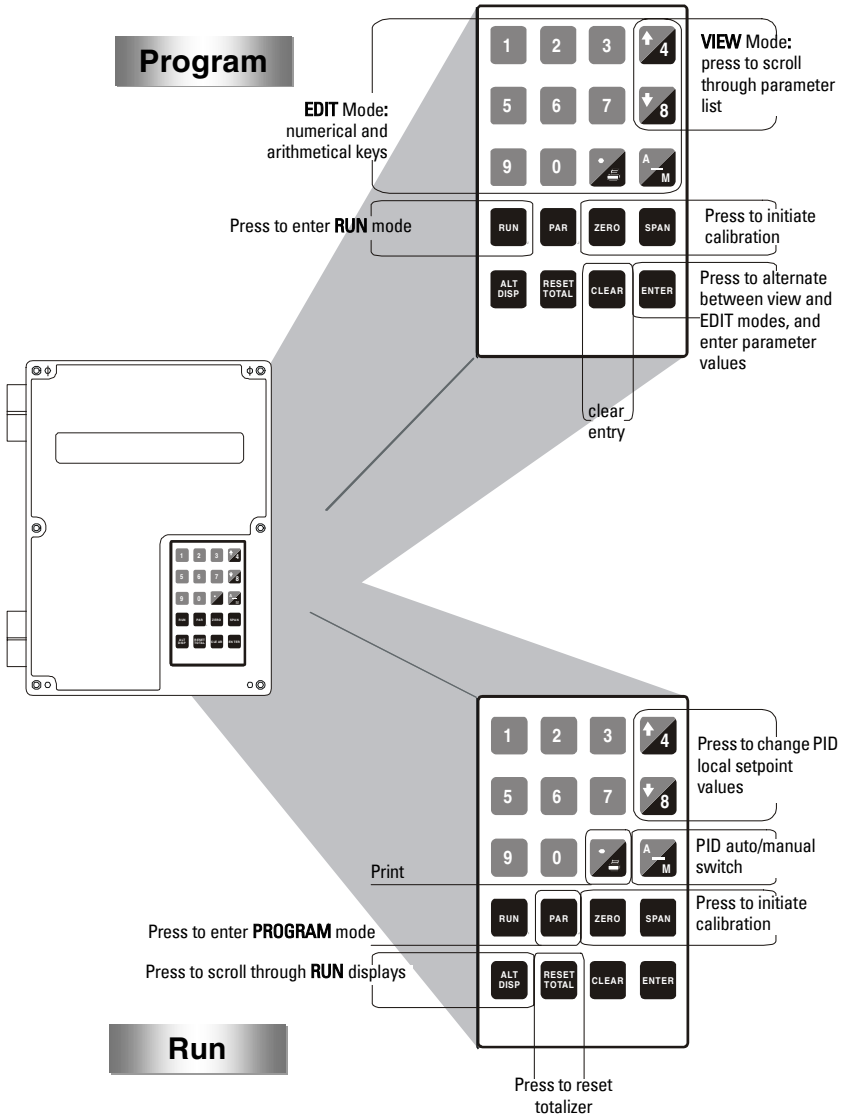
To Install a Plug-in Board

1. Turn off the power to the SF 500
2. Turn off any power provided to the relay contacts
3. Open the lid
4. Install the plug-in by mating the connectors
5. Secure it in place using the screws provided
6. For the SmartLinx® module only, route the communication cable along the right side of the enclosure wall to reduce interference. Consult the SmartLinx® documentation for any required hardware settings.
7. Close the lid
8. Restore power to the SF 500



Modes of Operation

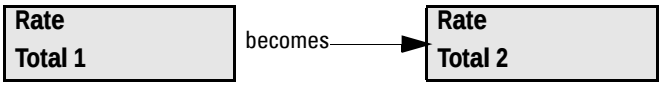
Display and Keypad



The SF 500 has two modes of operation: **PROGRAM** mode and **RUN** mode. With the keypad you can operate the SF 500 in either mode, and change between modes.

RUN is the normal or reference mode of operation. It continuously processes the rate signals from the flowmeter to produce internal rate signals. These are used as the basis for totalization (on page 51), mA output, relay control, and communication data. The **RUN**

display is programmed (P081) to scroll through rate, and totalization (P647), either automatically, or by pressing the enter key.



If the SF 500 is programmed for batch control, the batch display is added to the display scroll. Refer to *Batch Control (P560 - P568* on page 109 and *Batching* on page 66.

Access **PROGRAM** mode, zero and span calibration from **RUN** Mode.

PROGRAM mode allows viewing, and with security permission (P000), editing parameter values. While in **PROGRAM** mode, **RUN** mode functions are still active, i.e.: rate, relay, mA output and totalization. If **PROGRAM** mode is left idle for a period of ten minutes, the SF 500 automatically reverts to **RUN** mode.

Zero and span calibrations effectively halt **RUN** mode while they are in progress. During this time, totalization ceases, and all mA outputs, except for PID, fall to zero.

Key	PROGRAM Mode	RUN Mode
1	1	
2	2	
3	3	
4	4 (EDIT Mode), Scroll Up (VIEW Mode)	Scroll Up through PID Local Setpoint and Manual Output Values
5	5	
6	6	
7	7	
8	8 (**EDIT** Mode), Scroll Down (**VIEW** Mode	Scroll Down through PID Local Setpoint and Manual Output Values
9	9	
0	0	
.	Decimal Place	Print
A/M	- (Dash)	Toggle between PID auto/manual
RUN	Enter **RUN** Mode	
PAR		Enter **PROGRAM** Mode
ZERO	Press either the ZERO key or the SPAN key to initiate Calibration	Press either the ZERO key or the SPAN key to initiate Calibration

Key	PROGRAM Mode	RUN Mode
SPAN		
ALT DISP		Scrolls through **RUN** Displays
RESET TOTAL		Resets Totalizer 1
CLEAR	Clear Entry	
ENTER	Toggle between **VIEW** and **EDIT** or use to enter parameter values	

RUN Mode

To operate the SF 500 in **RUN** mode, program the unit with the base operating parameters.

If you enter **RUN** mode before satisfying the program requirements, the **PROGRAM** routine moves to the first missing item.

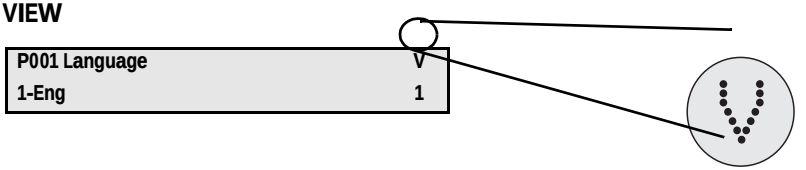
PROGRAM Mode

Use **PROGRAM** mode to change parameter values, and the way the unit operates.

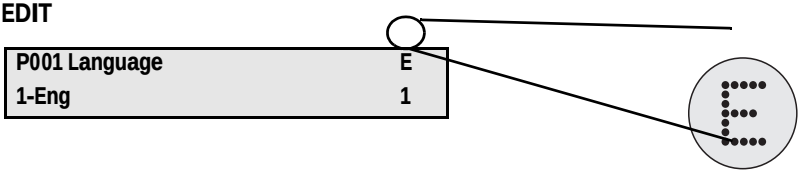
- When the unit is initially powered, it starts in **PROGRAM** mode
- Ensure that the SW1 is set to the right (see Layout diagram on page 7)
- Program parameters define the calibration and operation of the SF 500
- By entering **PROGRAM** mode, the user can view the parameter values or **EDIT** them to suit the application
- When in **PROGRAM** Mode the unit identifies the name of the parameter, the description, and the options or instructions for making a valid entry

PROGRAM Mode Display

VIEW



EDIT



Entering PROGRAM mode

Press PAR

P001 Language	**V**
1-Eng	**1**

The default of previous parameter view is displayed.
e.g. P001 is the default parameter for initial start up.

Selecting a parameter:

Scroll:

Press 4 to move up,

P002 Test Reference Selection	**V**
1-Weight, 2-ECal	**1**

e.g. scrolls up from P001 to P002.

Press 8 to move down.

P001 Language	**V**
1-Eng	**1**

e.g. scrolls down from P002 to P001

Accessing a parameter directly:

Press PAR

View/Edit Parameter	
Enter Parameter Number	

e.g. access P011, design rate

Press 0 1 1 ENTER in sequence.

P011 Design Rate:	**V**
Enter Rate	**100.00 kg/h**

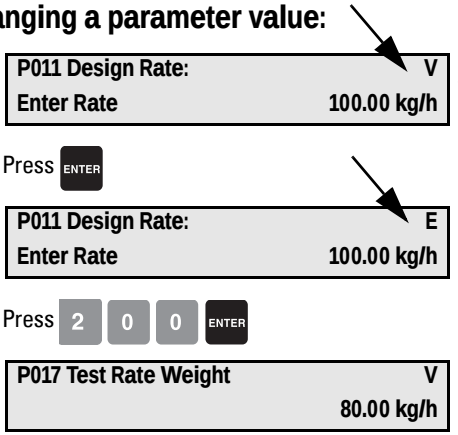
For direct access to index parameters

Or press 9 4 0 A/M 2 ENTER

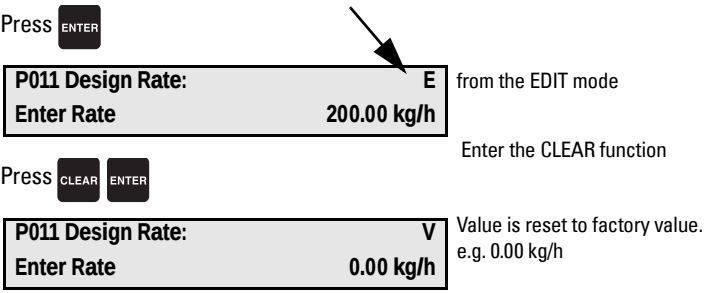
P940-2 Load Cell mV Signal Test	**V**
mV reading for B	**6.78**

e.g. access P940-2, load cell B mV signal

Changing a parameter value:



Resetting a parameter value:



Start Up

Notes:
- For successful start up, ensure that all related system components such as the flowmeter are properly installed and connected.
- Ensure that the SW1 is in the normal position, to the right. (See Layout diagram on page 7)

Initial start up of the SF 500 consists of several stages, and assumes that the physical and electrical installation of the solids flowmeter is complete:

- power up
- programming
- load cell balancing
- zero and span calibration

Power Up

Upon initial power up, the SF 500 displays:

P001 Language	**V**
1-Eng	**1**

The initial display prompts the user to select the preferred language.

Programming

Press 

The SF 500 then scrolls sequentially through the start up program as parameters P001 through P017 are addressed.

P002 Test Reference Selection	**V**
Select 1-Weight, 2-Ecal	**1**

e.g. Accept 'weight' (supplied with scale) as the test reference.

Press 

P003 Number of Load Cells	**V**
Enter (1 or 2)	**1**

e.g. Accept '1' as the number of load cells.

Press 

P004 Rate Measurement System	**V**
Select 1-Imperial, 2-Metric	**2**

e.g. Accept '2' for measurements in metric.

Press 4

P005 Design Rate Units:	V
Select: 1-t/h, 2-kg/h, 3-kg/min	1

e.g. Accept '1' for units in t/h

Press 4

P008 Date:	V
Enter YYYY-MM-DD	1999-03-19

default date

Press ENTER

P008 Date:	E
Enter YYYY-MM-DD	1999-03-19

e.g. enter current date of October 19, 1999

Press 1 9 9 9 A/M 1 0 A/M 1 9 ENTER

P009 Time:	V
Enter HH-MM-SS	00-00-00

factory set time 24 hour clock

Press ENTER

P009 Time:	E
Enter HH-MM-SS	00-00-00

Press 1 4 A/M 4 1 A/M 0 0 ENTER e.g. enter current time of 14:41

P011 Design Rate:	V
Enter Rate	0.00 t/h

factory design rate

Press ENTER

P011 Design Rate:	E
Enter Rate	0.00 t/h

e.g. rate of 100 t/h

Press 1 0 0 ENTER

P017 Test rate: Weight MS 1	V
Enter test rate	0.00 t/h

Press ENTER

P017 Test rate: Weight MS 1	E
Enter test rate	0 t/h

e.g. test rate of 75 t/h

Press 7 5 ENTER

This value is obtained from the design data sheet

The test rate value should be less than the design rate. If not, contact Siemens Milltronics.

P017 Test rate: Weight MS 1	**V**
Enter test rate	**75 t/h**

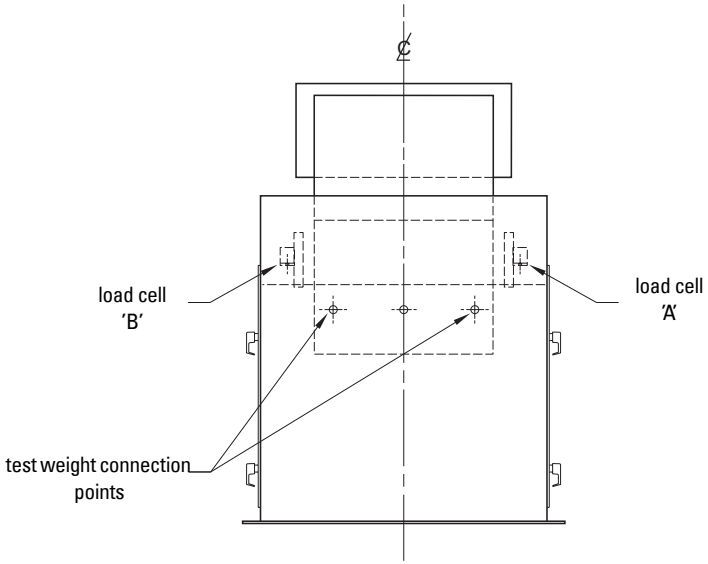
The initial programming requirements are now satisfied. To ensure proper entry of all critical parameter values, return to P002 and review parameters through to P017.

Load Cell Balancing

If you are operating a two-load cell solid flowmeter, balance the load cells electronically. Do this prior to initial programming and calibration, or after either or both load cells have been reinstalled or replaced.

Unbalanced load cells adversely affect the performance of your solids flowmeter weighing system.

Typical two load cell flowmeter

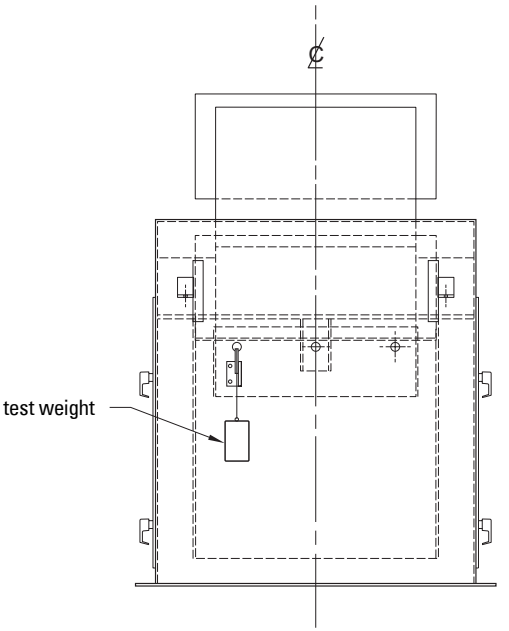


Access P295

P295 Load Cell Balancing:	**E**
Select: 1-A&B	**0**

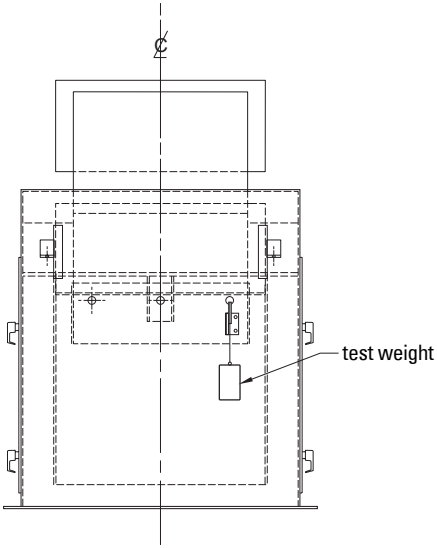
Press 1 ENTER

Load Cell Balancing A & B
Place weight at cell B and press ENTER



Press ENTER

Load Cell Balancing A & B
Place weight at cell A and press ENTER



Press ENTER

Load Cell Balancing A & B
Load cells are now balanced.

Balancing the load cell requires a subsequent zero and span calibration

Zero Calibration

Note: To obtain an accurate and successful calibration, ensure that no material is flowing through the flowmeter and that the test weights are not applied.

Press ZERO

Zero Calibration: Current Zero	**0**
Clear flowmeter. Press ENTER to Start	

the current zero count

Press ENTER

Initial Zero Calibration. In progress	
Current Reading:	**#####**

the zero count being calculated while calibration is in progress

The duration of the Zero calibration is dependent upon the present time duration and the (P360) calibration duration.

Press ENTER

Calibration Complete. Deviation	**0.00**
Press ENTER to accept value:	**551205**

the deviation from previous zero. For an initial zero there is no previous zero; hence the deviation is 0.

for example, the new zero count, if accepted

Press ENTER

Zero Calibration. Current Zero	**551205**
Clear flowmeter. Press ENTER to Start	

the current zero count of 551205

Accepting the Zero returns to start of Zero. Perform a new Zero, or continue to Span.

Span Calibration

When performing a Span Calibration where the test reference is ECal (P002 = 2), do not apply the supplied test weight and run the flowmeter empty.

Note: To obtain an accurate and successful calibration, ensure that there is no material flowing through the flowmeter and that the test weight is applied.

Stop the material flow and apply the test weight to the flowmeter as instructed in the flowmeter manuals.

Press SPAN

Span Calibration. Current Span	**0**
Setup test. Press ENTER to Start	

the current span count

Press ENTER

Initial Span Calibration. in progress	**0**
Current Reading	**####**

the span count being calculated while calibration is in progress

The duration of the Span calibration is dependent upon a preset time duration and the (P360) calibration duration. If P360=1, the span duration is approximately 20 seconds.

if

Span Count too Low.
Press CLEAR to continue.

signal from load cell or LVDT too low, ensure proper test weight is applied during calibration

check for proper load cell or LVDT wiring

Press ENTER

Calibration Complete. Deviation	**0.00**
Press ENTER to accept value:	**36790**

the deviation from the previous span. For an initial span, there is no previous span count; hence the deviation is 0.

for example, the new span count, if accepted.

Press ENTER

Span Calibration. Current Span	**36790**
Setup test. Press ENTER to Start	

for example, the current span count

Accepting the Span returns to start of Span. Perform a new Span or enter **RUN** mode. Before returning to **RUN** mode, remove the test weight from the flowmeter and store it in a secure place.

RUN Mode

Proper programming and successful zero and span calibration allow entry into the **RUN** mode. Otherwise, entry is denied and the first missing item of programming or calibration is displayed.

Press RUN

Rate	**0.00 kg/h**
Total 1	**0.00 kg**

e.g. if there is no material flowing through the flowmeter. The current rate is 0 and no material has been totalized.

Once initial programming is complete and the SF 500 can operate in **RUN** mode, you may now put the flowmeter into normal service. The SF 500 is functioning under its initial program and calibration, reporting rate of material flow and totalizing.

If the initial entry and operation in **RUN** mode is successful, recalibrate the weighing system by performing a series of material tests. Material tests verify that the SF 500 is reporting accurately. Where any inaccuracies exist, correct the system with a manual span adjustment (P019).

Perform recalibration of the zero and span routinely to maintain accurate reporting of rate and total.

Refer now to *Recalibration* on page 30.

Material Tests

Perform material tests to verify the accuracy of the span calibration and compensate for material flow. If the material tests indicate a repeatable deviation exists, a manual span adjust (P019) is then performed. This procedure automatically alters the span calibration and adjusts the test rate (P017) value, yielding more accurate span recalibrations.

If the span adjust value is within the accuracy requirements of the weighing system, the material test was successful. Resume normal operation.

Note: Test weights are NOT used during material tests.

If the span adjust value is not acceptable, repeat the material test to verify repeatability. If the result of the second material test differs considerably, consult Siemens Milltronics or any of its agents.

If the span adjust values are significant and repeatable, perform a manual span adjust.

There are two methods of executing the manual span adjust: *% Change* and *Material Test*

- *% Change*: based on the material test, the difference between the actual weight of material and the weight reported by the SF 500 is calculated and entered into P019 as % change.
- *Material Test:* based on material test, the actual weight of material is entered into P019.

The method of execution is a matter of preference, and yields the same result.

% Change

To run a % Change material test:

1. Stop material flow.
2. Perform a zero calibration.
3. Put the SF 500 into **RUN** mode
4. Record the SF 500 total as the start value _ _ _ _ _ _ (e.g. 17567.0)
5. Run material at a minimum of 50% of design rate for a minimum of 5 minutes.
6. Stop the material feed.
7. Record the SF 500 total as the stop value _ _ _ _ _ _ (e.g. 17995.5)
   Subtract the start value from the stop value to determine the SF 500 total
8. Determine the weight of the material sample.

   SF 500 total = _ _ _ _ _ _(e.g. 428.5 kg)

   material sample weight = _ _ _ _ _ _ (423.0 kg)

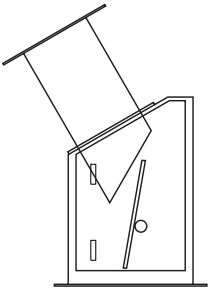
Calculate the span adjust value:

% span adjust =

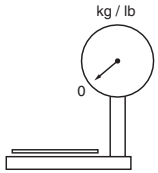
$$\frac{\text{SF 500 – material sample weight}}{\text{material sample weigh}} \times 100$$

e.g. $\frac{(428.5-423.0)\times 100}{423}$

=1.3%

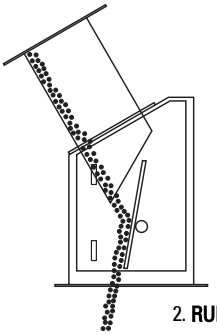


1. zero calibration

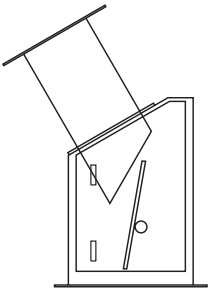


empty scale

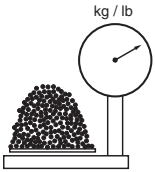
start total



2. **RUN** mode



3. stop material feed



4. weigh material

Access P019 and enter EDIT mode

P019 Manual Span Adjust	**E**
Select 1-% Change 2-Material Test	**0**

Press 1 ENTER

P598 Span Adjust Percentage	**V**
Enter Calculated +/- error	**0.00**

Press ENTER

P598 Span Adjust Percentage	E
Enter Calculated +/- error	0.00

Press A/M 1 . 3 ENTER

if % change is negative, remember to enter the minus sign, e.g. -1.3

P017 Test Rate Weight: MS1	V
Enter Test Rate	56.78

e.g. the new test rate value is displayed

Material Test

The Material Test option allows the SF 500 to calculate the size of the material sample as recorded by its totalizers and allows the operator to directly enter the actual weight of the material sample. The % error is calculated and can be accepted or rejected by the operator.

Access P019 and enter EDIT mode

P019 Manual Span Adjust	E
Select 1-% Change 2-Material Test	0

Press 2 ENTER

Material Test
Add to Totalizer 0-No, 1-Yes

if yes, the weight of the material test will be added to the totalizer, if no, material is added to test totalizer (4) only.

Press 0 ENTER

Material Test
Press ENTER to start

e.g. do not add weight of material test to totalizer

Press ENTER

Material Test	#.###
Press ENTER key to stop	

the totalizer reading as the material test is run

Press ENTER

Material Test	964.032
Enter actual amount	

e.g. the weight totalized by the solids flowmeter and SF 500

Press 9 7 5 . 6 3 3 ENTER

e.g. 975.633 kg is the actual weight of the material test

Material Test Deviation	-1.19
Accept 0-No, 1-Yes:	

e.g. the calculated deviation is displayed as a % of the actual weight

Press 1 ENTER

P017 Test Rate Weight: MS1	**V**
Enter Test Rate	**56.78**

e.g. the new test rate value is displayed.

Verify the results of the span adjust by material test or return to normal operation.

Design Changes

Changes to parameters that impact on the calibration do not take effect until a recalibration is done.

If significant changes have been made perform a P377, Initial Zero (see page 34) and/or a P388, Initial Span (see page 37).

Recalibration

To maintain the accuracy of the weighing system, recalibrate the zero and the span periodically. Recalibration requirements are dependent upon the severity of the application. Perform frequent checks initially. As time and experience dictate, reduce the frequency of these checks. Record any deviations for future reference.

The displayed deviations are referenced to the previous zero or span calibration. Deviations are tallied for successive zero and span calibrations. When their limit is exceeded an error message shows that the deviation or calibration is out of range.

Routine Zero

Note: To obtain an accurate and successful calibration, ensure that no material is flowing through flowmeter and that test weights are not used.

Press ZERO

Zero Calibration. Current Zero	**551205**
Clear flowmeter. Press ENTER to start	

e.g. the current zero count

Press ENTER

Zero Calibration in progress	
Current Reading:	**0.01 kg/m**

e.g. the rate reported while calibration is in progress

Calibration complete. Deviation	**0.02**
Press ENTER to accept value	**551418**

e.g. the calculate deviation in % of full span

e.g. the new zero count, if accepted

if unacceptable, press CLEAR to restart

if

Calibration is out of range	
Deviation report:	**403.37**

This indicates that the mechanical system is errant. Use P377, initial zero, judiciously and only after a thorough mechanical investigation.

Find and correct the cause of the increased deviation. Then re-try a zero recalibration. If this deviation is acceptable, set P377 to 1 to invoke an initial zero calibration. Further deviation limits are now based on this new initial zero.

Press ENTER

Zero Calibration. Current Zero	**551418**
Clear flowmeter. Press ENTER to start	

e.g. zero calibration is accepted and displayed as the current zero

End of Zero Calibration. Proceed with Span Recalibration or return to **RUN**.

Initial Zero

Perform an initial zero if necessary when a **calibration is out of range** message is shown.

Access P377 and enter EDIT mode

P377 Initial Zero	**E**
Enter 1 to start initial Zero	**0**

Press 1 ENTER

Zero Calibration. Current Zero	**530560**
Clear flowmeter. Press ENTER to start	

e.g. the current zero

Press ENTER

Initial Zero Calibration in progress	
Current Reading:	**#####**

the zero count being calculated while calibration is in progress

Calibration complete. Deviation	**0.00**
Press ENTER to accept value	**551413**

e.g. the deviation from the previous zero

e.g. the new zero count if accepted

Press ENTER

if unacceptable, press CLEAR to restart

Zero Calibration. Current Zero	**551413**
Clear flowmeter. Press ENTER to start	

e.g. the current zero count

Note: This is the end of zero calibration. Proceed with zero or span recalibration or return to **RUN**.

Direct Zero

Use direct zero entry (P367) when replacing software or hardware, if it is not convenient to perform an initial zero. A record of the last valid zero count is required.

Access P367 and enter EDIT mode

P367 Direct Zero Entry	**E**
Enter Zero Count	**0**

enter the last valid zero count, e.g. 551401

Press 5 5 1 4 0 1 ENTER

Zero Calibration. Current Zero	**V**
Enter Zero Count	**551401**

e.g. the last valid zero count

Auto Zero

Use Auto Zero to perform a zero calibration automatically when flow stops.

The Auto Zero function provides automatic zero calibration in RUN mode if all of these conditions are met:

- the auto zero input (terminals 29/30) is in a closed state; jumper or remote contact
- the rate of flow is between +2 and -2% of the design rate (P011)
- The terminal and rate status coincide for at least one calibration period (P360)

The rate display is interrupted by the Auto Zero routine

Rate	**0.00 t/h**	
Total 1:	**0.00 tonnes**	**AZ**

(AZ flashes on and off)

Calibration Complete. Deviation	**0.0**
Auto-Zero value	**551410**

e.g. typical zero and deviation values

The duration of the auto zero is one or more calibration periods (P360). If either condition is interrupted during those periods, the auto zero is aborted and the RUN display resumes. There is no loss of totalization. After one calibration period, another auto zero is attempted if the input and rate conditions are met.

If the resulting zero deviation is less than an accumulated 2% from the last operator initiated zero, the auto zero is accepted.

If the deviation is greater than an accumulated 2%, an error message is displayed. The error message is cleared after five seconds, however if a relay is programmed for diagnostics, it remains in alarm so long as the Auto Zero conditions are being met.

If material feed resumes during an auto zero function, the zero is aborted and the totalizing function restarts where it left off.

Routine Span

Note: To obtain an accurate and successful calibration, ensure that no material is flowing through flowmeter and the test weight is applied

Press SPAN

Span Calibration. Current Span 41285 **Setup test. Press ENTER to start**	e.g. the current span count

if

Zero should be done prior to Span **Setup test. Press ENTER to start.**	do a zero calibration or press CLEAR

Press ENTER

Span Calibration in progress **Current Reading: 55.56 t/h**	the rate reported while calibration is in progress.

Calibration complete. Deviation 0.03 **Press ENTER to accept value 41440**	e.g. the deviation from the previous span e.g. the new span count, if accepted

if if unacceptable, press CLEAR to restart

Span Count too Low. **Press CLEAR to continue.**	if the signal from the load cell or LVDT is too low, ensure proper test weight is applied during span

Calibration is out of range **Deviation Error:**	check for proper load cell /LVDT wiring

This indicates that the mechanical system is errant. Use P388, initial span, judiciously and only after a thorough mechanical investigation.

Find and rectify the cause of the increased or decreased deviation. Then re-try a span recalibration.

If this deviation is still unacceptable, set P388 to 1 to invoke an initial span calibration. Further deviation limits are now based on this new initial span.

Press ENTER

Span Calibration. Current Span 41440 **Setup test. Press ENTER to start**	e.g. span calibration is accepted and displayed as the current value

This is the end of span calibration. Remove the test weight and return to **RUN**.

Initial Span

Note: Perform an initial span when a **calibration out of range** message is shown.

Perform a zero calibration prior to performing a span calibration.

Access P388 and enter EDIT mode

P388-01 Initial Span	**E**
Enter 1 to start INitial Span	**0**

Press 1 ENTER

Span Calibration. Current Span	**41440**
Setup test. Press ENTER to start	

e.g. the current span count

If

Zero should be done prior to Span	
Setup test. Press ENTER to start	

do a zero calibration or press ENTER

Press ENTER

Initial Span Calibration in progress	
Current Reading:	**#####**

the span count being calculated while calibration is in progress

Calibration complete. Deviation	**0.00**
Press ENTER to accept value	**41900**

the deviation is reset

e.g. the new span value if accepted

Press ENTER

if unacceptable, press CLEAR to restart

Span Calibration. Current Span	**41900**
Setup test. Press ENTER to start	

e.g. the current span count

Remove the test weight and return to **RUN**.

Direct Span

Direct span entry (P368) is intended for use when replacing software or hardware, and when it is not convenient to perform an initial span. A record of the last valid span count is required.

Access P368 and enter EDIT mode

P368 Direct Span Entry	**E**
Enter Span Count	**0**

Press 4 1 9 0 0 ENTER

P368 Direct Span Entry	V
Enter Span Count	41900

e.g. the last valid span count, e.g. 41900

Multispan

The SF 500 offers a multispan function. The SF 500 can be calibrated for up to eight different products or feed conditions that produce varying flowrate characteristics. Different feed conditions are typically related to running different materials or multiple feed locations. To accommodate such applications, make a span correction by selecting and applying the appropriate span.

Since every material has its own unique physical properties, and may have a different impact, a span calibration is required for each material to ensure maximum accuracy. With different feeder locations, a span calibration may be required to match each feedpoint or combination of feedpoints.

Each time one of the eight conditions is in effect, select the corresponding multispan prior to putting the SF 500 in RUN mode. Either change the multispan operation number (P365), or program the external contacts connected to the auxiliary input, P270.

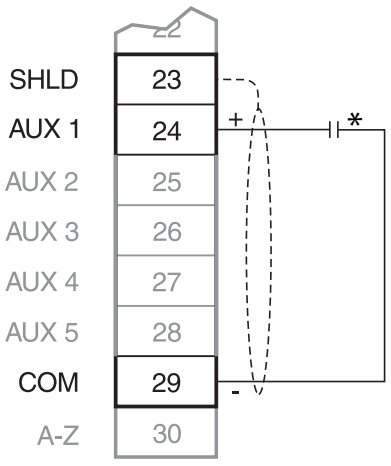
To enable multispan operation, address the following:

- connections
- programming

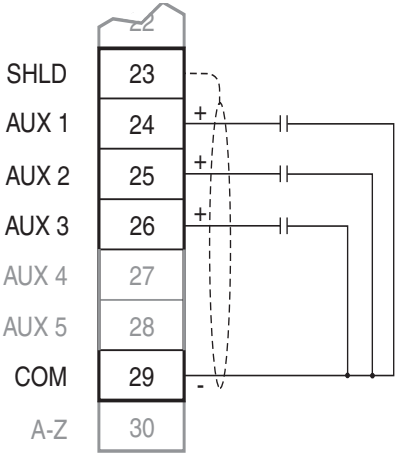
Connections

If the span selection is to be done by remote contact, the following connections would apply. Otherwise, no additional connections to the SF 500 are required.

Multispan Selection of Spans 1 and 2



Multispan Selection of Spans 1 to 8



*Remote contact can be from relay or open collector switch.

Access P365 and enter EDIT mode

P365 Multispan	**E**
Select [1-8]	**0**

Span 1 will have already been set as part of the Start Up and initial calibration. Therefore, select **2**.

Access P017 and enter EDIT mode

P017 Test Rate: Weight MS2	**E**
Enter Test Rate	**0**

Enter the test rate value, and press SPAN to do a span calibration.

To do a span calibration for another condition, (i.e. span 3 or 4 etc.), access P365 and repeat these steps for each condition. As with any initial span, follow the span calibration for each multispan with a material test and factoring.

To use remote span selection, auxiliary inputs, 1 and/or 2 or 3, are programmed to read the contact state as the span selection. Remote selection overrides the keypad (or Dolphin Plus) selection. The auxiliary inputs override the keypad selection.

Access P270 and enter EDIT mode

P270-01 auxiliary Input Function	**E**
Select Function [0-13]	**0**

Enter 6. This programs auxiliary Input 1 (terminal 24) to read the contact state for span selections: 1 or 2.

Access P270 and enter EDIT mode (when using spans 3 and/or 4)

P270-02 auxiliary Input Function	**E**
Select Function [0-13]	**0**

Enter 6. This programs auxiliary Input 2 (terminal 25), in conjunction with auxiliary input 1 to read the contact state for span selections 3 and 4.

Access P270 and enter EDIT mode (when using spans 5 to 8)

P270-03 auxiliary Input Function	**E**
Select Function [0-13]	**0**

Enter 6. This programs auxiliary input 3 (terminal 26), in conjunction with auxiliary input 1 and auxiliary input 2 to read the contact state for span selections 5 to 8.

Remote selection of a span is not enabled until a span calibration has been done. Initial span selection must be done via the Multispan parameter, P365.

Operation

When span calibration is done, press RUN to revert to the **RUN** mode.

Rate kg/h	**0.00 kg/h**	**MS2**
Total 1:	**0.00 kg**	

e.g. if there is no material flowing, the current rate is 0 and no material has been totalized.

When the material to be run changes, the multispan is changed to the corresponding span. This is completed either by changing the span value entered in P365, or by closing the appropriate contacts connected to the programmed auxiliary inputs.

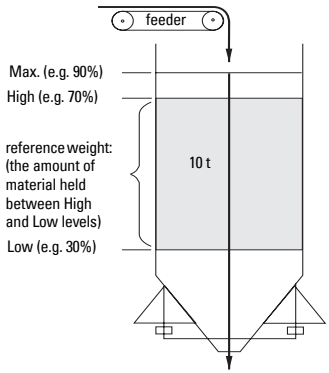
Span	auxiliary Input Aux 1	Multispan Selection Aux 2	Multispan Selection Aux 3
1	⊣⊢	⊣⊢	⊣⊢
2	⫤	⊣⊢	⊣⊢
3	⊣⊢	⫤	⊣⊢
4	⫤	⫤	⊣⊢
5	⊣⊢	⊣⊢	⫤
6	⫤	⊣⊢	⫤
7	⊣⊢	⫤	⫤
8	⫤	⫤	⫤

If required, reset or note the totalizer value, as the process materials being conveyed may change. Refer to *Totalization (P619-P648)* on page 111.

Linearization applies concurrently to spans.

On-line Calibration

The On-line Calibration feature may be used to routinely check, and if necessary adjust, the Span calibration in RUN mode, without interrupting the material flow.



Install a weigh bin, (bin or silo equipped to provide a 4 to 20 mA output proportional to weight), preceding the material infeed.

Connect the weigh bin to one of the mA inputs on the optional mA I/O board of the Milltronics SF 500: either mA input 1, terminals 5 and 6; or mA input 2, terminals 7 and 8.

Install a material feed control device, preceding the weigh bin.

Note:

- Press PAR twice, to enter a parameter number directly.
- Whenever you wish to change a value, press ENTER to enable the EDIT mode.

P355 On-line Calibration Feature	**E**
Select: 0-Off, 1-On	**0**

EDIT mode: value can be changed

Select the On-line Calibration feature:

Access

P355 On-line Calibration Features	**V**
Select: 0-OFF, 1-ON	**1**

Value is accepted

Press 1 ENTER

Enter the weigh bin reference weight, (the amount of material the bin holds between the High and Low levels), in units selected in P005.

Access

P356 On-line Calibration	**V**
Enter Reference Weight	**10.000**

e.g. reference bin weight

Press 1 0 ENTER

Enter the Max., High, and Low limit setpoints as a percentage in parameter 357.

Access

P357-01 On-line Calibration Limits	V
MAX Limit:	90.0

← limit as a percentage

Press 9 0 ENTER

Access

P357-02 On-line Calibration Limits	V
HIGH Limit:	70.0

Press 7 0 ENTER

Access

P357-03 On-line Calibration Limits	V
LOW Limit:	30.0

Press 3 0 ENTER

Calibrate the mA inputs on the SF 500 to the 4 and 20 mA levels of the weigh bin. 4 mA is calibrated with the weigh bin empty, using P261-01 or –02. 20 mA is calibrated with the weigh bin full, using P262-01 and P262-02.

Assign one of the mA inputs for the On-line Calibration function.

Access

P255-01 mA Input Function	**V**
Select 0, 1-PID SP, 2-PID FV, 3-OCAL	**3**

e.g. mA input 1 set to 3

Press 3 ENTER

Assign one of the 5 relays, P100-01 to P100-05, to the On-line Calibration function.

Access

P100-01 Relay Function	**V**
Select Function [0-9] (see manual)	**9**

e.g. relay 1 set to 9

Press 9 ENTER

Program the assigned relay using P118, relay logic, so that when you connect the assigned relay to the weigh bin material feed control device, the weigh bin material feed stops when the On-Line relay is energized.

Activate On-line Calibration.

Access

P358 On-line Calibration Features		**V**
0-OFF,	**1-ACTIVE**	**1**

Press 1 ENTER

Note: For remote access, On-line Calibration can also be activated using one of the auxiliary inputs (refer to *P270 Auxiliary Input Function* on page 100).

When the On-line Calibration is activated, normal operation continues until the weigh bin fills to the maximum level, (90% in the example shown). During the filling stage, the current level is displayed as a percentage.

On-line Calibration -	**LOW > 19%**
Wait for LEVEL > MAX	**RLY**

current level displayed as percentage

When the maximum limit is reached, the relay assigned to the On-line Calibration function energizes to stop the weigh bin material feed.

On-line Calibration -	**94% > MAX**
Wait for LEVEL < HIGH	**RLY 1**

Material continues to be discharged from the weigh bin, and when the level drops to the High limit (70% in the example) the On-Line totalizer is automatically activated.

On-line Calibration -	**TOTAL 3.71 tonnes**
Calibration in progress	**RLY 1**

running total

When the Low limit (30%) is reached, the totalizer is deactivated and the assigned relay is de-energized, which reopens the material feed to the weigh bin.

The SF 500 On-line material total, the amount of material totalized between the High and Low limits, is compared to the value entered in P356. The deviation percentage between these values and the new Span count value is displayed.

On-line Calibration	**Deviation**	**2.51%**	← deviation percent
Press ENTER to accept	**New span**	**22280**	← new Span count value

Press ENTER to accept the results.

On-line Calibration Complete		
Press ENTER to accept	**New span**	**22280**

Note:
- Deviation must be no greater than ± 12% of the initial span or it will not be accepted.
- For remote access, On-line Calibration can be accepted using one of the auxiliary inputs (refer to *P270 Auxiliary Input Function* on page 100).

If you want to reject the results and return to RUN mode, press RUN.

Rate	**0.00 t/h**
Total 1:	**10.15 t**

Note: For remote access, to return to RUN mode, program one of the auxiliary inputs (refer to *P270 Auxiliary Input Function* on page 100).

If you want to reject the results and perform another on-line calibration, press PAR to return to P358.

Access

P358 On-line Calibration Features		**V**
0-OFF,	**1-ACTIVE**	**1**

Press 1 ENTER

If the deviation is greater than ± 12%:

Calibration is out of range
Deviation Error:

1. Rerun on-line calibration to verify the deviation: press PAR to return to P358.
2. Verify the mechanics of the flowmeter: carry out material tests to ensure the readings are correct. (See page 30,)
3. If the mechanics are functioning correctly, perform an initial span using P388. (See page 37.)

Factoring

To calculate the value of a new or unknown test weight to the current span, use the factoring procedure.

Note: For optimum accuracy in the factoring results, a routine zero calibration is recommended prior to performing the factoring routine.

With the material flow turned off:

Access P359 in VIEW mode

P359 Factoring	**V**
Enter 1 to start factoring	**1**

Press 1 ENTER

Factoring Weight	
Place weight and press ENTER.	

e.g. factor the test weight

Press ENTER

Factoring Weight	
Factoring in progress	**##.##**

the rate reported while factoring is in progress.

Factoring Weight	
Press ENTER to accept value	**45.25**

e.g. the new factor, if accepted

Press ENTER

P359 Factoring:	**V**
Enter 1 to start factoring	**1**

Note: If multispan function is used, the test rate value is stored for the current multispan only.

Linearization

In applications where the ideal flowmeter location has been compromised, or where there is a high degree of variation in flow rates, the flowmeter may report rate non-linearly. The SF 500 provides a linearizing function (P390 - P392) to correct for this deficiency in the weighing system and to provide an accurate report of the actual process.

To verify that the cause of the non-linearity is not mechanical:

- Stop the feeding system.
- Remove the flowmeter cover and suspend increasingly heavier test weights to the sensory mechanism to verify mechanical linearity. For each test weight, note the flow value. If the rate reported by the SF 500 is non-linear, a mechanical problem is indicated. Refer to the flowmeter manual to resolve the non-linearity.

If it is determined that the non-linearity is due to the weighing application, apply linearization by performing the following:

- zero calibration
- span calibration at 90 to 100% of design rate
- material tests at 90 to 100% of design rate
- manual span adjust if required
- repeat material tests at 1 to 5 intermediary flow rates where compensation is required.

Note: Compensation points must be at least 10% of the design load apart.

- calculate the percentage compensation for each flow rate tested.

$$\% \text{ compensation} = \frac{(\text{actual weight} - \text{totalized weight}) \times 100}{\text{totalized weight}}$$

Where:

actual weight = material test
totalized weight = SF 500 total

Note:

- After programming the compensation into the SF 500, run a material test to verify the effect of linearization.
- If additional compensation is required, it must be based on new material tests performed with the linearization turned off (P390 = 0).

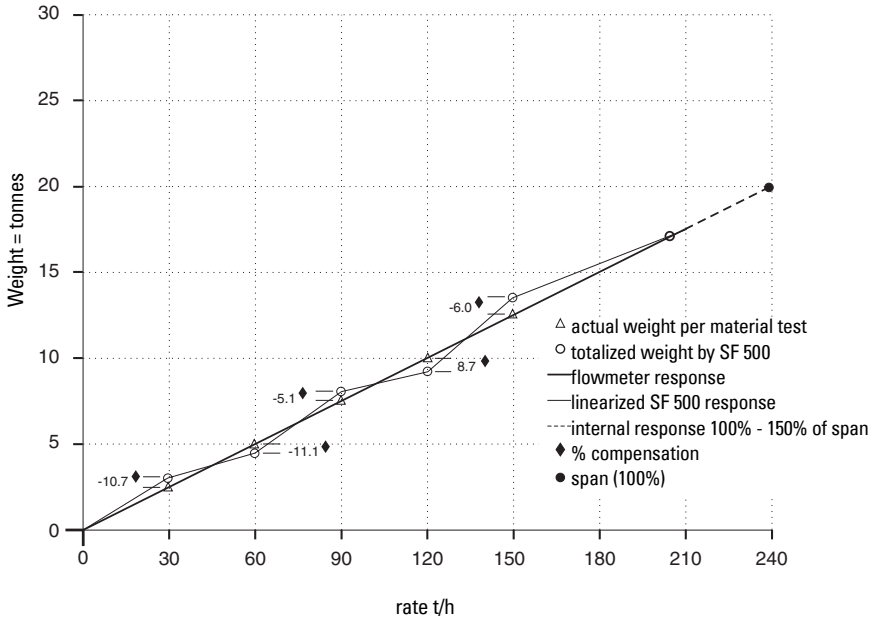
Example:

A non-linearity in the ideal response exists in a solids flowmeter application with a design rate of 200 t/h. Material tests are performed at 15, 30, 45, 60, and 75% of the design rate. Perform a zero and a span calibration at 100% of the design rate, followed by material tests and manual span adjust. The five material tests are performed at 30, 60, 90, 120, and 150 t/h, as indicated by the SF 500. The following data is tabulated. (This example is exaggerated for emphasis.)

SF 500 rate t/h	material test tonnes	SF 500 total tonnes	compensation* %
30	2.5	2.8	-10.7
60	5.0	4.5	11.1
90	7.5	7.9	-5.1
120	10.0	9.2	8.7
150	12.5	13.3	-6.0

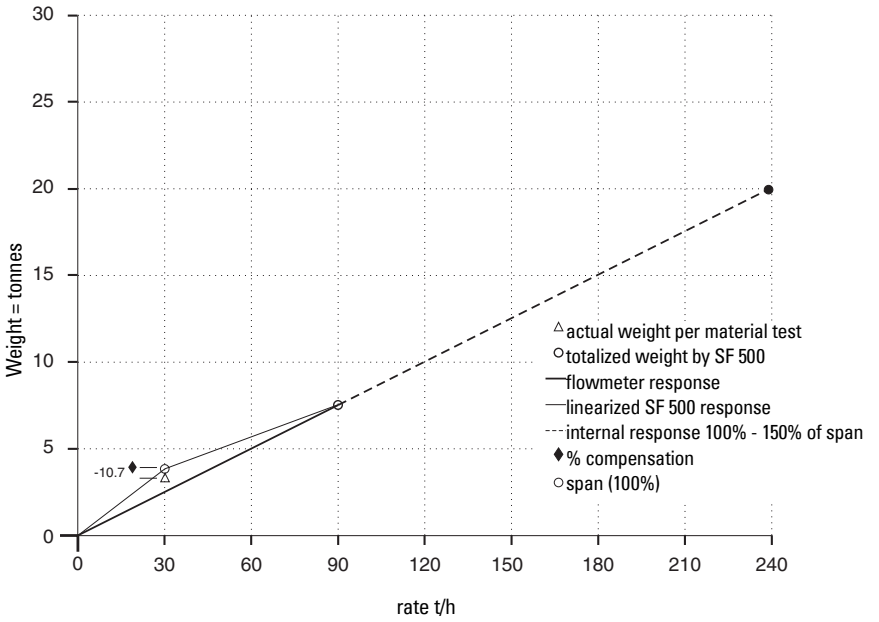
*calculation example: % compensation = $\frac{2.5 - 2.8}{2.8} \times 100$

$= -10.7$



Program the SF 500 as follows:

Parameter	Function
P390 = 1	linearization ON
P391-01 = 30	point 1, rate
P391-02 = 60	point 2, rate
P391-03 = 90	point 3, rate
P391-04 = 120	point 4, rate
P391-05 = 150	point 5, rate
P392-01 = - 10.7	point 1, compensation
P392-02 = 11.1	point 2, compensation
P392-03 = - 5.1	point 3, compensation
P392-04 = 8.7	point 4, compensation
P392-05 = -6.0	point 5, compensation
Note: Often only one point of compensation is required, usually at a low rate value. In the prior example, if compensation was only required at 30 t/h, program the following parameters. Optimize compensation by establishing the next rate value that agrees with the material test, the compensation is zero and is entered as the next compensation point.	
P390 = 1	linearization on
P391-01 = 30	point 1, rate
P391-02 = 90	point 2, rate
P392-01 = -10.7	point 1, compensation
P392-02 = 0	point 2, compensation



Rate Sensing

For the SF 500 to calculate rate and totalize material flow through the flowmeter, a rate signal representative of material flow is required. The rate signal is provided by the flowmeter. The SF 500 is compatible with flowmeters fitted with one or two strain gauge type load cells. To function with LVDT type sensors, an optional LVDT conditioning card is required.

Refer to *Specifications* on page 3 for flowmeter requirements, and *Interconnection* on page 9 for the proper connection.

Damping

Damping (P080) provides control over the speed at which the displayed rate reading and output functions respond to changes in the internal rate signals. The damping controls change in the displayed rate of material flow. Relay alarm functions based on input functions of rate respond to the damped value.

Damping consists of a first order filter applied to the signal (reading or output value).

If mA damping (P220) is enabled (value other than 0), then the damping (P080) as it pertains to the mA function is overridden, and responds independently at the specified mA output damping rate (P220).

Note: Damping (P080-01 or P220) is not applicable to the mA output when programmed for PID function (P201 = 2).

mA I/O (0/4-20 mA)

Output

The standard SF 500 provides one isolated mA output (P201). The output range can be set to 0 - 20 mA or 4 - 20 mA (P200). The 0 or 4 mA value corresponds to no flow or zero condition, whereas the 20 mA value corresponds to the associated design rate (P011). The mA output can be limited for over range levels of 0 mA minimum and 22 mA maximum (P212 and P213 respectively). The output 4 and 20 mA levels can also be trimmed (P214 and P215 respectively) to agree with a milliamp meter or other external mA device.

The mA output value can be tested to output a prescribed value using parameter P911. Refer to *P911 mA Output Test* on page 116.

The optional mA I/O board provides two additional mA outputs, programmable as outputs 2 and 3, using the same parameters as the standard output (1). If programmed for PID

control, output 2 is assigned to PID control loop 1 and output 3 is assigned to PID control loop 2.

Input

The optional mA I/O board provides two mA inputs, programmable as inputs 1 and 2. If programmed for PID control, assign input 1 to PID control loop 1 and input 2 to PID control loop 2.

The input range can be set to 0-20 mA or 4-20 mA (P250), and assigned a function (P255), e.g. PID setpoint. The 4 and 20 mA levels can be trimmed (P261 and P262) to agree with an external device.

Relay Output

The SF 500 offers five single pole single throw (SPST) relays that can be assigned (P100) to one of the following alarm functions:

- rate: relay alarms on high and/or low material flow rate.
- diagnostic: relay alarms on any error condition as it is reported. Refer to *Troubleshooting* on page 118.
- PID: PID control setpoint deviation*
- batch pre-warn
- batch setpoint

*is offered only if the PID system (P400) is enabled.

For rate alarm functions, enter the high and low alarm setpoints (P101 and P102 respectively) in the appropriate units. The high alarm setpoint acts as the setpoint deviation alarm for relays programmed for PID setpoint deviation.

The on/off actuation at both high and low setpoints is buffered by the damping (P080) and the programmable dead band (P117), to prevent relay chatter due to fluctuations. The relay is normally energized; holding the normally open (n.o.) contact closed (can be programmed for reverse operation, P118). In an alarm condition, the relay is de-energized and the relay contact is opened. Once in alarm, the relay remains in alarm state until the alarm condition is removed.

Example:
P011 = 360 t/h
P100 = 1-rate
P101 = 100% (360 t/h)
P102 = 20% (72 t/h)
P117 = 2% (7.2 t/h)

Alarm is ON with relay de-energized.

Totalization

The totalization function is based on the internal rate (mass per unit time) signal proportional to flow rate and load on the associated flowmeter. It is not affected by the damping function (P080). The rate signal is sampled several times a second to accurately count the mass of material conveyed. The count is held in the master totalizer used to increment the internal totalizers and to produce a pulse signal for the remote totalizers.

The SF 500 provides several separate totalizer functions:

Internal totalizers

- local display (totalizers 1 and 2)
- verification totalizer (totalizer 3)
- material test totalizer (totalizer 4)
- batch total (totalizer 5)

External totalizers

- totalizer outputs (remote totalizers 1 and 2)

To avoid totalizing material at flow rates below the low flow rate limit, the totalizer drop out limit (P619) is set to a percentage of the design load. Below this limit, totalization stops. When material flow returns to a rate above the drop out limit, totalization resumes.

Totalizer resolution or count value is set by the respective internal (P631) and external (P638) totalizer resolution parameters.

e.g.: **Internal totalizer 1**

Given: P005 = 1 (t/h)
P631 = 4

Then: totalizer count increments by 10 for each 10 metric tonnes registered

External totalizer 1

Given: P005 = 1 (t/h)
P638 = 5

Then: contact closure occurs once for every 10 metric tonnes registered

For remote totalization, the contact closure duration (P643) is automatically calculated upon entry of the design rate (P011) and remote totalizer (P638) parameters, so that the duration of contact closure allows the relay response to track the total up to 150% of the design rate. The value can be changed to suit specific contact closure requirements, such as in the case of programmable logic controllers. If the duration selected is inappropriate, the next possible duration is automatically entered.

The totalizers are reset through the master reset (P999), the totalizer reset (P648) or through the keypad.

- master reset: the reset of all totalizer functions is included in the master reset.
- totalizer reset: totalizer reset can be used to resets internal totalizers 1 and 2, or totalizer 2 independently. Resetting the internal totalizers 1 and 2 resets the internal registers for external totalizers 1 and 2.
- keypad: pressing RESET TOTAL CLEAR while in the **RUN** mode resets internal totalizer 1

Placing the internal totalizers on to the display scroll of the **RUN** mode is controlled by the totalizer display parameter (P647). This displays either one or both totalizers.

PID Control

The PID control algorithm in the SF 500 works for feed rate control applications. It is based on motor control type algorithms and includes several anti-windup provisions.

To operate the SF 500 as a controller, address the following:

- hardware
- connections
- setup and tuning
- programming

Hardware

For the SF 500 to operate as a controller, install the optional mA I/O board. Refer to *Interconnection* on page 9.

Connections

In addition to the standard operating connections, make connections to the process instruments.

Refer to:

- *Interconnection* on page 9, specifically:
- *Relay Output* for relay connections on page 15
- *mA I/O Board* on page 16, for mA input and output connections
- *Auxiliary Inputs* on page 12, for optional remote control

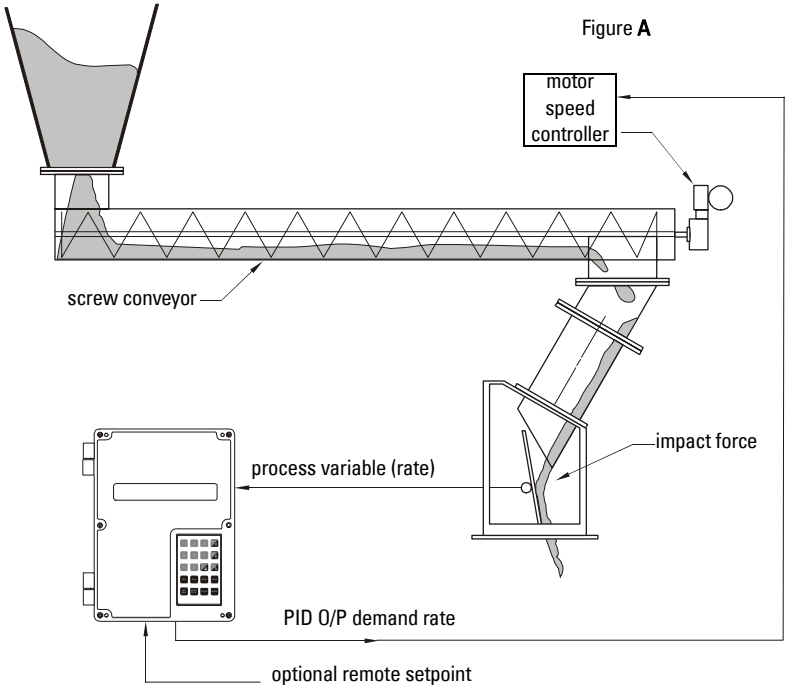
Connect the SF 500 as either a:

1. setpoint controller – rate control
2. setpoint controller – external process variable with or without rate control

PID loop	mA output	terminals (mA I/O)	mA input	terminal (mA I/O)
1	2	1 & 2	1	5 & 6
2	3	3 & 4	2	7 & 8

Setpoint Controller – Rate Control

Figure **A**



	Parameter	Index			Choices
		01	02	03	
Controller Selection	P400-	1	0^{f}	----	0=Off, 1=Man, 2=Auto
Process Variable Source	P402-	1^{f}	1^{f}	----	1=Rate, 2=mA I/P 1, 3=mA I/P 2
Setpoint Configuration	P414-	0^{f*}	0^{f}	----	0=Local, 1=mA I/P 1, 2=mA I/P 2
mA O/P Function	P201-	1^{f}	2	1^{f}	1=Rate, 2=PID
mA I/P Function	P255-	0^{f*}	0^{f}	----	0=Off, 1=PID Set-point, 2=PID Process Variable

*Set to 1 for Remote Setpoint operation

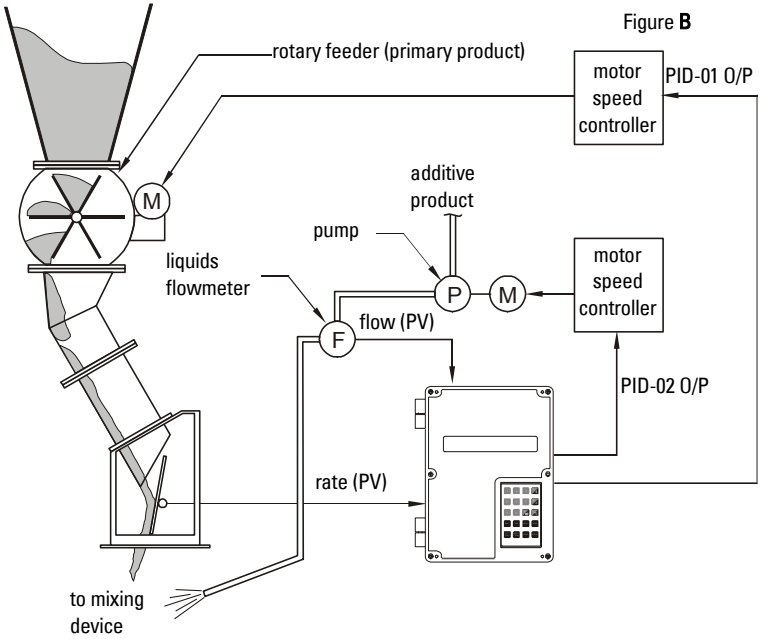
Default Value = ^{f}

Comments:

1. Connect signal to controlled device to mA O/P 2
2. For Remote Setpoint (optional). Connect remote 4-20 mA setpoint to I/P mA 1

Setpoint Controller – Rate and Additive Control

Figure **B**



	Parameter	Index			Choices
		01	02	03	
Controller Selection	P400-	1	1	----	0=Off, 1=Man, 2=Auto
Process Variable Source	P402-	1[f]	2	----	1=Rate, 2=mA I/P 1, 3=mA I/P 2
Setpoint Configuration	P414-	0	2	----	0=Local, 1=mA I/P 1, 2=mA I/P 2
mA O/P Function	P201-	1[f]	2	2	1=Rate, 2=PID
mA I/P Function	P255-	2	1	----	0=Off, 1=PID Set-point, 2=PID Process Variable
Remote Ratio	P418-	100[f]	100[f]	----	Setpoint=% of input

Default Value = [f]

Comments:

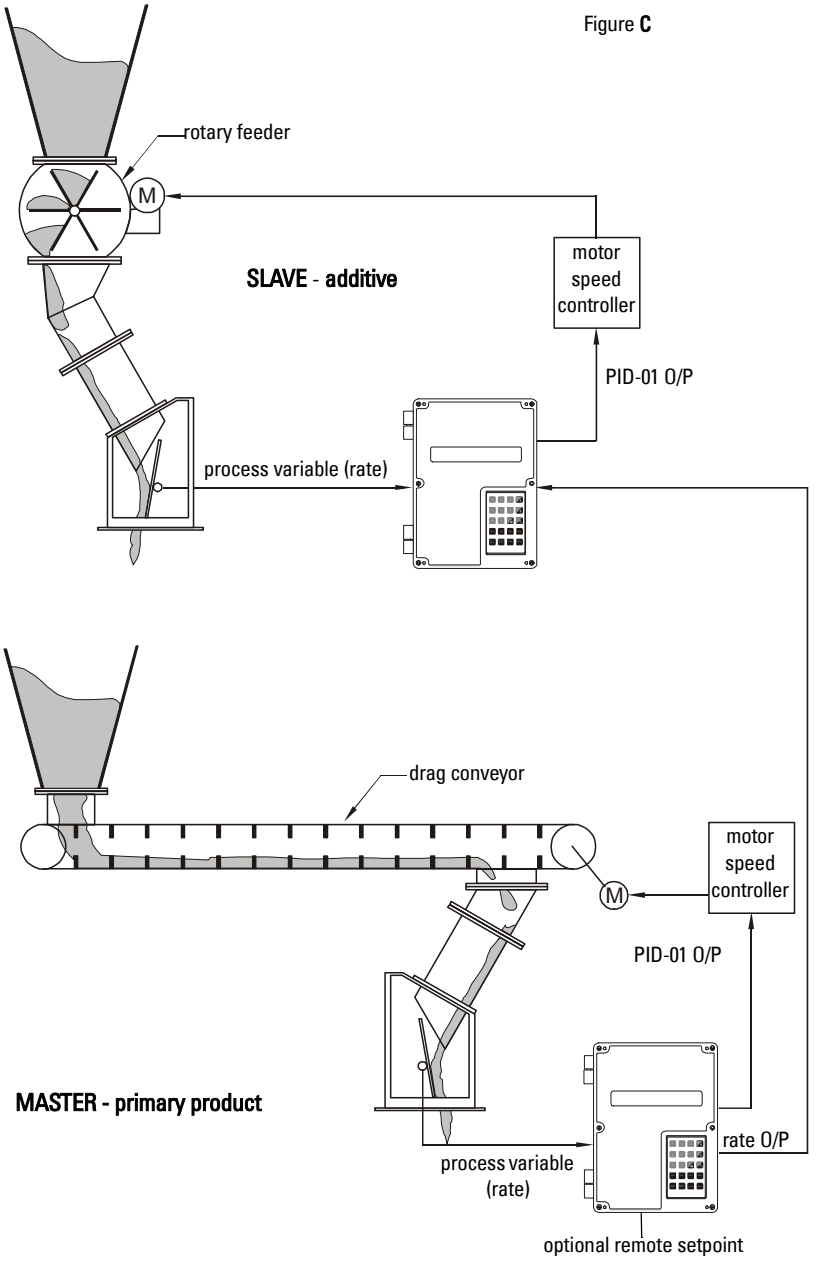
1. Connect primary rate controlled device to mA O/P 2
   Connect additive rate controlled device to mA O/P 3
   Connect additive process variable to mA I/P

   Hardwire mA O/P 1 to mA O/P 2

2. Ratio of Additive to Primary product may be adjusted by changing P418-02

Setpoint Controller – Master/Slave Control

Figure **C**



SF 500 - Master

	Parameter	Index			Choices
		01	02	03	
Controller Selection	P400-	1	0^f	----	0=Off, 1=Man, 2=Auto
Process Variable Source	P402-	1^f	1^f	----	1=Rate, 2=mA I/P 1, 3=mA I/P 2
Setpoint Configuration	P414-	0^f	0^f	----	0=Local, 1=mA I/P 1, 2=mA I/P 2
mA O/P Function	P201-	1^f	2	1^f	1=Rate, 2=PID
mA I/P Function	P255-	0^f	0^f	----	0=Off, 1=PID Set-point, 2=PID Process Variable
Remote Ratio (optional)	P418-	100^f	100^f	----	Setpoint=% of input

Default Value = ^{f}

Comments:

1. Connect Rate output of SF 500-Master mA O/P 1, or mA O/P 3 to mA I/P 1 of SF 500-Slave
   Connect signal to controlled device from mA O/P 2
2. For Remote Setpoint on Rate Control (optional)
   Connect remote 4-20 mA setpoint to mA I/P 1
   Ratio of Primary product to remote setpoint may be adjusted by changing P418-01

SF 500 - Slave

	Parameter	Index			Choices
		01	02	03	
Controller Selection	P400-	1	0^f	----	0=Off, 1=Man, 2=Auto
Process Variable Source	P402-	1^f	1^f	----	1=Rate, 2=mA I/P 1, 3=mA I/P 2
Setpoint Configuration	P414-	1	0^f	----	0=Local, 1=mA I/P 1, 2=mA I/P 2
mA O/P Function	P201-	1^f	2	1^f	1=Rate, 2=PID
mA I/P Function	P255-	1	0^f	----	0=Off, 1=PID Set-point, 2=PID Process Variable
Remote Ratio (optional)	P418-	100^f	100^f	----	Setpoint=% of input

Default Value = ^{f}

Comments:

1. Connect primary rate controlled device to mA 2 O/P
2. Ratio of Additive to Primary product may be adjusted by changing P418-01

Setup and Tuning

Before proceeding, it would be beneficial to qualify and quantify the terms you will encounter in the setup and tuning of the control system.

Proportional Control (Gain), P

The P term adjusts the control output, based on the difference between the set point and the measured flow rate. A higher P term increases the sensitivity of the SF 500 unit, allowing it to react more quickly to changes or disturbances. If set too high, the SF 500 becomes less stable, and more susceptible to oscillations in the control output.

- allowable input range: 0.000 to 2.000
- typical operating range: 0.300 to 0.600
- default value: 0.400

The control output cannot reach the setpoint using only the P term. Since the P term acts on the difference between the **setpoint** and **process variable**, a small difference between these two always exists. The difference is never zero. A small P term can get the process very close to set point, but this takes a long time. At minimum, an I term is required to eliminate the offset created by the P term.

Integral Control (Automatic Reset), I

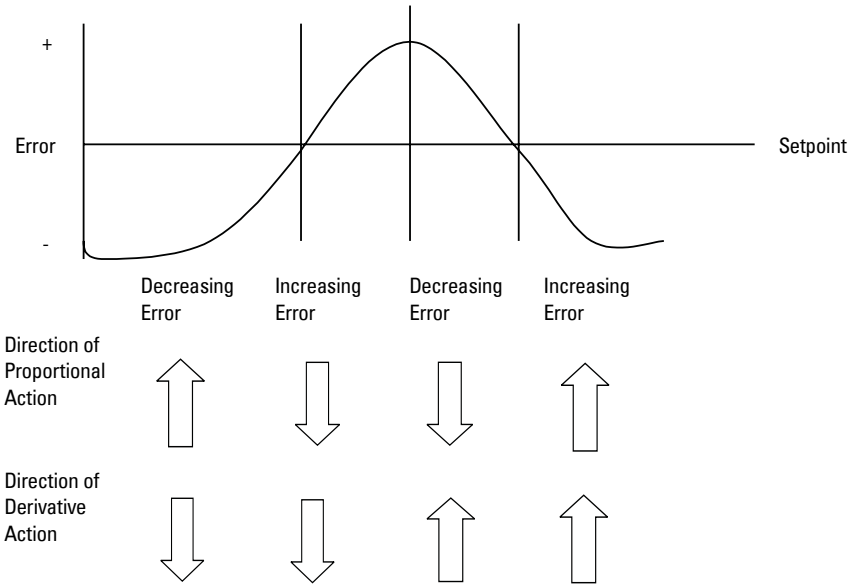
The I term on the SF 500 is used to increase or reduce the amount of control output to eliminate the offset caused by the P term. The I term acts on the accumulation of the error over small increments of time. As the process reaches setpoint and the error becomes small, the effect of the I term decreases. A higher I term allows the SF 500 to react to changes faster, but can also make it less stable.

- allowable input range: 0.000 to 2.000
- typical operating range: 0.100 to 0.300
- default value: 0.200

The P and I terms together can make a suitable control algorithm and for many applications, they work fine. However, if faster response to changes is desired, it is necessary to use larger P and I terms. Unfortunately, larger terms can make the system unstable. A derivative term is needed to influence the control output as the process variable approaches the set point.

Derivative Control (Pre-Act or Rate), D

The D term on the SF 500 influences the control output based on changes in the magnitude and direction of the change in error. If there is a constant error, the D term has no effect. As the error gets larger, the D term combines with the P term to make the SF 500 control output respond faster. When the error is getting smaller, the D term acts to reduce the amount of control output to help prevent overshooting the set point. In general, a higher P term requires a larger D term.



- allowable input range: 0.000 to 1.000
- typical operating range: 0.010 to 0.100
- default value:0.050

The result of the derivative action is that it can make a system more responsive and more stable at the same time.

Feed Forward Control, F

The F term is used to adjust the control output based on a setpoint change. The use of this term can make the system reach the new setpoint faster. If the term is not used, the system responds using the P, I, and D terms only. The difference between the new setpoint and the process variable is the error and the control algorithm responds to eliminate this new error.

When the F term is used and a new setpoint is entered, a proportion of the difference between the new setpoint and the process variable is automatically added on to the control output. This shifts the process variable closer to the new setpoint faster than using the P, I, and D terms alone. This is done on a one-time basis.

- allowable input range: 0.000 to 1.000
- typical operating range: 0.250 to 0.550
- default value: 0.300

The PID control function of the SF 500 can be configured to operate in several modes.

- controller output: direct acting
- feedback: rate, load or external
- control: local or remote (ratio) setpoint

PID Setup and Tuning

Proper tuning of the control PID terms is essential to system operation and optimum performance from the feeder. The recommended procedures for tuning the PID control terms at initial startup are described in this section.

Notes:

- Meet Zero and Span criteria
- Set controller (P400=1) to manual and adjust the output for 0% flow (using the 4 and 8 keys). Material must not flow through flowmeter.
- Shut off the prefeed to, or ensure that no material is fed into the flowmeter.

Initial Start Up

Although the default values of the P, I, D, and F terms suit the majority of applications, some tuning is necessary.

There are several techniques and procedures for tuning conventional PID controllers. Some work better depending upon the application. We recommend using **closed-loop cycling** for the SF 500 integrator/controller for feed rate control. First, tune the P term while disabling the I and D terms. Then add and tune the I term, and then the D term.

To outline this procedure:

1. With the P term set to its default value of 0.400, disable the I, D and F terms by setting them to 0.000.
2. Enter a feed rate setpoint that is 30% of the designed maximum flow rate.
3. Start the pre-feeder and observe the time it takes the pre-feeder to reach setpoint. Observe the oscillation around setpoint.
4. Adjust the P term accordingly for consistent oscillation and error. Progressively decrease the P term value if there is too much oscillation and error. Likewise, increase the value if the error is not consistent and oscillating around the setpoint. Refer to fig 1, 2, and 3 below.

Figure 1

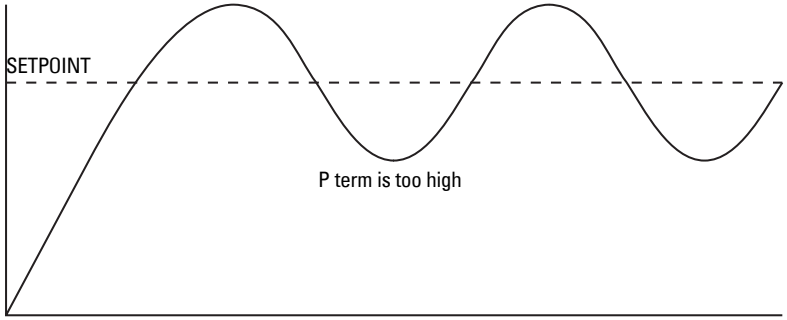


Figure 2

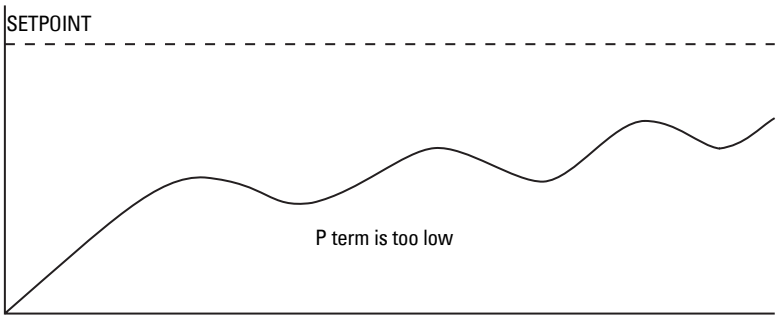
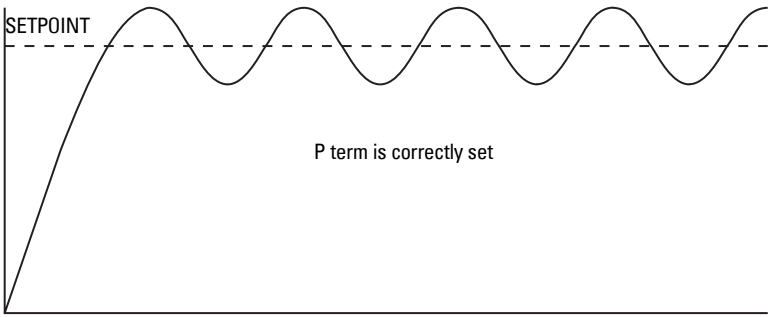


Figure 3



5. Once the P term value is set to give the control output of the SF 500 consistent oscillation and the error is at its minimum, turn the pre-feeder off.
6. The I term value can now be set. Begin by entering the default value of **0.2**.
7. Restart the pre-feeder (test weights or chains still applied) and feed rate setpoint entered.
8. Again observe the oscillation of the control output. Compare results to the figures 4,5 and 6 below.

Figure 4

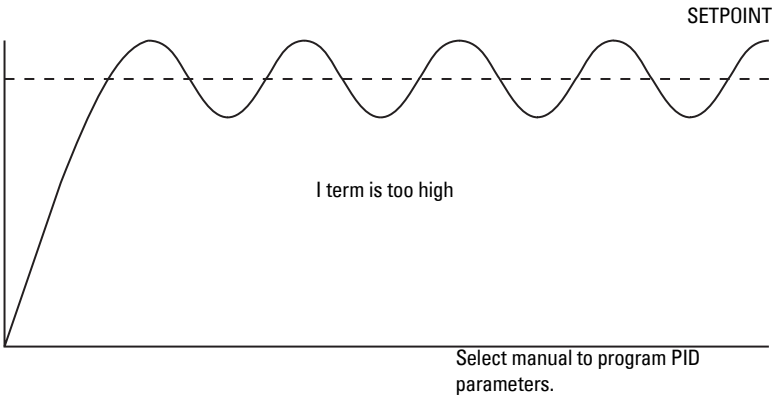


Figure 5

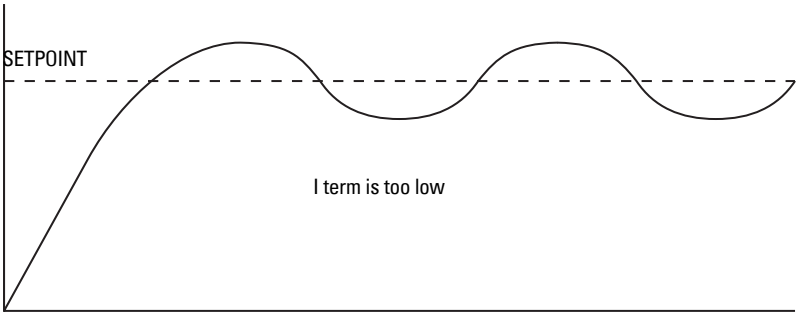
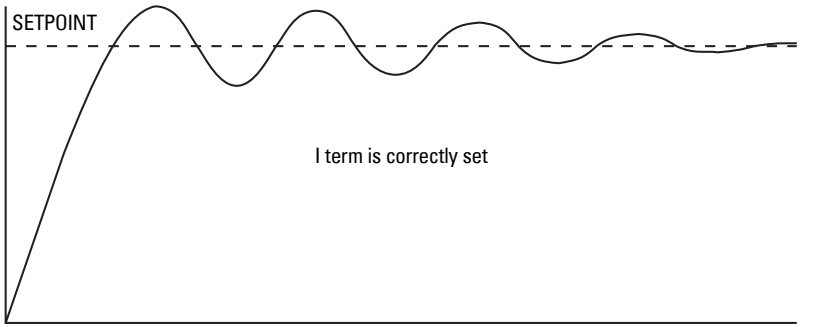


Figure 6



9. The D term is not critical in most pre-feeder applications. The purpose of the D term is to anticipate where the process is heading by looking at the time rate and direction of change of the process variable. The D term becomes very useful in applications where the material control point is far away from the measuring point, e.g. a long screw feeder more than a few seconds process time from the flowmeter.

A properly set D term makes the initial oscillations around the setpoint smaller, as in figure 6. A D term set too high induces high oscillations, as in figure 4. Omission of the D term, or set too low, shows no effect on the system.

10. The above closed loop cycling procedure allows ease in start up, but final adjustments may be necessary in actual process operation.

Programming

The SF 500 must be programmed to take advantage of the PID algorithms.

The SF 500 offers programming for two separate PID controls, 1 and 2. The controller being programmed is identified by the index to the parameter number. E.g. P400-01 indicates that PID for control system 1 is accessed.

.

Note: All programming should be done in the PID manual mode.

Access

P400-01 PID System	**E**
Select: 0-Off, 1-Manual, 2-Auto	**0**

To program PID parameters, select 1-Manual.

Off disables the PID parameter set, P401 to P418. They are not accessible.

Manual: the control output is the manual output P410.

Auto: engages the PID controller function. This can also be done using the  key.

Note:
For the mA output:
- mA output 2 (P201-02) is normally reserved for controller 1. The signal is output at terminals 1 and 2 on the mA I/O board.
- mA output 3 (P201-03) is normally reserved for controller 2. The signal is output at terminals 3 and 4 on the mA I/O board.

P201-02 mA Output Function	**E**
Select: 1-Rate, 2-PID	**1**

Select the PID function.

Note:
For the mA input:
- mA input 1 is an external signal normally reserved for controller 1. The signal is input at terminals 5 and 6 on the mA I/O board.
- mA input 2 is an external signal normally reserved for controller 2. The signal is input at terminals 7 and 8 on the mA I/O board.

P250-01 mA Input Range	**E**
Select 1- 0 to 20, 2-4 to 20	**2**

Select the appropriate range for the mA input signal

P255-01 mA Input Function	**E**
Select: 0, 1-PID SP, 2-PID PV	**0**

Assign either:
1, PID setpoint, or
2, process variable as the function of the mA input

P401-01 PID Update Time	**E**
Readings between PID Updates	**1**

Enter the value, e.g. nominal value of 1

P402 Process Variable Source	**E**
1-Rate, 2-mA In1, 3-mA In 2	

Select the source. Rate is an internal values.

P405-01 Proportional Term	**E**
Enter	**0.40**

Enter the value for the proportional term, e.g. nominal value of 0.4

P406-01 Integral Term	**E**
Enter	**0.2**

Enter the value for the integral term, e.g. nominal value of 0.2

P407-01 Derivative Term	**E**
Enter	**0.05**

Enter the value for the derivative term, e.g. nominal value of 0.05

P408-01 Feed Forward Term	**E**
Enter	**0.3**

Enter the value for the feed forward term, e.g. nominal value of 0.3

P410-01 Manual Mode Output	**E**
Current Output Value	**0**

% value of output during manual operation, P400 = 1

P414-01 Setpoint Configuration	**E**
0-Local, 1mA In 1, 2-mA In 2	**0**

Selection of setpoint source:
0 = local (keypad or Dolphin Plus)
1 or 2 = mA input

Local: the setpoint is the value entered into P415.

mA Input 1: the setpoint is the mA value on input 1, terminals 5 and 6 on the mA I/O board.

mA Input 2: the setpoint is the mA value on input 2, terminals 7 and 8 on the mA I/O board.

P415-01 Local Setpoint Value	**E**
Enter Setpoint	**0**

Enter the setpoint value in engineering units.

Not applicable if P414 = 1 or 2

P416-01 External Setpoint	**E**
Setpoint	**0**

Current setpoint value in engineering units, obtained from the mA input

P418-01 Remote Setpoint Ratio	**V**
Enter % of Master Output	**100.000**

Increase or decrease to scale input setpoint, if desired.

P250-01 mA Input Range	**E**
Select 1- 0 to 20, 2-4 to 20	**2**

Select the appropriate range for the mA input signal

P255-01 mA Input Function	**E**
Select 0, 1-PID SP, 2-PID PV	**0**

Assign either:

1. PID setpoint, or
2. process variable as the function of the mA input

Batching

The batching process, as it relates to the SF 500 operation, can be defined as the transfer of a predetermined quantity of material.

The process supports a count up operation (P560), in that the total (totalizer 5) begins at zero and increments up to the programmed setpoint (P564). A relay (RL1 through 5) programmed as the batch setpoint function (P100 = 8) is actuated when the material total reaches the setpoint. The relay contact acts as an interlock to the material feed to end the batch.

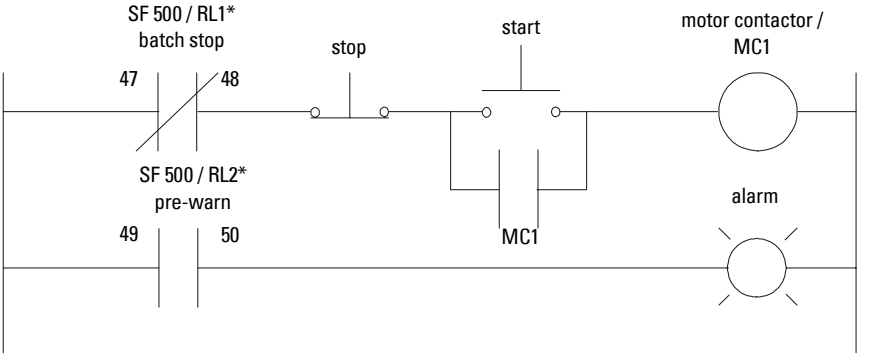
Another relay can be programmed as a pre-warn alarm (P100 = 7), to alert the process that batch end is near. The relay is actuated when the material total reaches the pre-warn setpoint (P567) at some practical value below the batch setpoint). The pre-warn function is enabled / disabled from the batch process through P566.

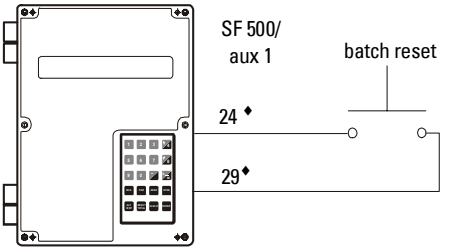
For batch operations, the following must be addressed:

- connections
- programming
- operation

Connections

Typical Ladder Logic





* Typical relay assignment. Relays 1-5 are available for batch setpoint or pre-warn alarm function.

♦ Typical auxiliary input assignment. Inputs 1- 5 are available for batch reset.

The pre-warn function is optional.

The setpoint associated with the pre-warn relay is entered in P564, batch setpoint.

The setpoint associated with the batch relay is entered in P567, batch pre-warn setpoint.

Batch Operation	
Access P560 Batch Mode Control	Select 1, enable batch operation
Access P564 Batch Setpoint	Enter the desired batch total
Access P566 Batch Pre-warn	Set to ON (1) or leave it OFF (0)
If batch pre-warn is selected, access P567 Batch Pre-Warn Setpoint	Enter the Pre-warn total
Access P568 Batch Pre-act	Set to OFF (0) or AUTO (1) or manual (2)

Relays	
Access P100, Relay Function	Select relay (1 – 5)
	Select function 5, Pre-Warn
Access P100 Relay Function	Select relay (1-5, other than the pre-warn relay)
	Select function 6, Setpoint

Operation

Once the SF 500 relays are connected to the process logic and it is programmed, the SF 500 is ready for totalizing the batch and stopping the process when the batch setpoint is reached. The batch operations start, pause, resume, and cancel are controlled externally by the process control (e.g. PLC)

Place the unit in the **RUN** mode.

Press ALT DISP until the batch screen is displayed.

Rate	**0.00 kg/h**	**SP:**	**20.000**
Batch	**0.00 kg**		

e.g relay 1 is programmed for pre-warn, P100-1 = 5

Start running the batch.

The display will show the rate of material flow and the batch total, as well as the batch setpoint. If pre-warn is used, relay contact is open.

When the batch total reaches the pre-warn setpoint, if programmed, the alarm event is removed and the assigned relay contact is closed.

Rate	**123.4 kg/h**	**SP:**	**20.000**
Batch	**17.00 kg**		**ALM 1**

The process continues. When the batch total reaches the batch setpoint, the alarm event is displayed and the assigned relay is actuated (contact opened). Typically the relay contact would be integrated into the batch control logic to end the process.

Rate	**123.4 kg/h**	
Batch	**20.00 kg**	**ALM 12**

e.g. relay 2 is programmed for batch setpoint, P100-2=6

When the next batch is to be run, pressing and then on the local keypad, or providing a momentary contact closure across an auxiliary input (programmed as batch reset, P270 = 8), sets the alarm display and resets the batch total to zero, and the relay contact to its closed state.

Rate	**0.00 kg/h**	**SP:**	**20.000**
Batch	**0.00 kg**		

Note: The batch totalizer can be viewed as a read-only parameter (931-05), using single Parameter access through any programmed communication port.

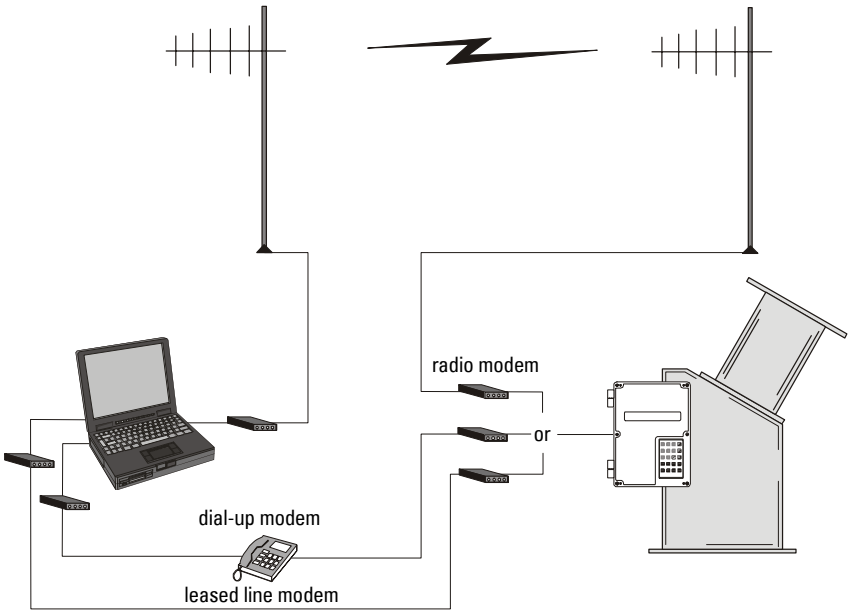
Pre-act Function

If repetitive batches are being run, the pre-act function (P568) can be enabled to automatically trip the setpoint relay before or after the batch setpoint is reached in order to assure best batch accuracy.

Or, in manual mode, enter a set value to cause the batch setpoint to pre-act at a designed accumulation.

Communications

The SF 500 is an sophisticated flow meter integrator that can communicate status back to a SCADA system using a serial device such as radio modems, leased lines, or dial up modems.



The SF 500 supports two protocols: Dolphin and Modbus. Dolphin is a proprietary Siemens Milltronics protocol designed to be used with Dolphin Plus. Modbus is an industry standard protocol used by popular SCADA and HMI systems.

SF 500 and SmartLinx®

In addition to three onboard communication ports, the SF 500 is compatible with Siemens Milltronics SmartLinx® communication modules which provide an interface to popular industrial communication systems.

This section only describes the onboard communications. For more information on SmartLinx®, please consult the appropriate SmartLinx® manual.

⚠ **WARNING: When a SmartLinx® card is installed and P799 = 1 (Communications Control parameter), the parameters that the SmartLinx® card is writing to the SF 500 will be continuously updated. Therefore, if you connect a SmartLinx® card to the SF 500, set P799 = 1 and not write anything to the SmartLinx® card, your setpoints will be 0.**

Connection

There are three serial communication ports on the SF 500:

Port	Description
1	RS-232, Terminals 31 to 34
2	RS-485, terminals 41 to 46
3	RS-232, RJ-11 modular telephone jack

Refer to *Installation* on page 6 for wiring diagrams specific to each port.

Wiring Guidelines

Improper wiring and choice of cables are the most common sources of communication problems. Listed below are some suggested guidelines:

- 15 meters (50 feet) for RS-232
- 1200 meters (4000 feet) for RS-485
- Ensure that communication cable is run separately from power and control cables (i.e. do not tie wrap your RS-232 cable to the power cable or have them in the same conduit).
- cable is shielded and connected to ground at one end only
- 24 AWG (minimum)
- follow proper grounding guidelines for all devices on the bus
- use good quality communication grade (shielded twisted pairs) cable that is recommended for RS-232.

Configuring Communication Ports

The SF 500 communications ports are setup by a series of parameters (P770 – P789) which are indexed by port.

The communication parameters are indexed to the following:

Port	Description
1	RS-232, Terminals 31 to 33
2	RS-485, terminals 41 to 45
3	RS-232, RJ-11 modular telephone

f indicates the factory setting.

Note: Changes to these parameters do not take effect until the power to the unit is cycled.

P770 Serial protocols

The communications protocol used between the SF 500 and other devices for the selected port, ports 1 to 3 (P770-01 to –03).

The SF 500 supports Siemens Milltronics' proprietary Dolphin data format plus the internationally recognized Modbus standard in both ASCII and RTU formats. It also supports direct connection of a printer.

The Siemens Milltronics protocol is compatible with the Dolphin Plus configuration program. See the Siemens Milltronics web site for information on this PC product (http://www.siemens-milltronics.com/).

The Modbus protocol is an open standard developed by AEG Schneider Automation Inc. Specifications are available from their web site (http://www.modicon.com/).

Other protocols are available with optional SmartLinx® cards.

Values

0 communications disabled *f -01 and -02*
1 Siemens Milltronics "Dolphin" protocol *f -03*
2 Modbus ASCII slave serial protocol
3 Modbus RTU slave serial protocol
4 printer

Note: SF 500 must be in **RUN** mode to allow for the print operation.

P771 Protocol address

Note: Applicable only to ports programmed for Modbus RTU or Modbus ASCII (Parameter 770).

The unique identifier of the SF 500 on the network for the selected port, ports 1 to 3 (P771-01 to -03).

For devices connected with the Siemens Milltronics protocol this parameter is ignored.

For devices connected with a serial Modbus protocol this parameter is a number from 1-247. It is up to the network administrator to 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.

Values

0 to 9999 (*f* = 1)

P772 Baud Rate

The communication rate with the master device for the selected port, ports 1 to 3 (P772-01 to –03).

The baud rate chosen should reflect the speed of the connected hardware and protocol used.

Values

1 4800 baud *f*-01 and -02
2 9600 baud
3 19,200 baud *f*-03

P773 Parity

The serial port parity for the selected port, ports 1 to 3 (P773-01 to –03).

Ensure that the communications parameters are identical between the SF 500 and all connected devices.

e.g many modems default to N-8-1 which is No parity, 8 data bits, and 1 stop bit.

Values

0 none*f*
1 even
2 odd

P774 Data bits

The number of data bits per character for the selected port, ports 1 to 3 (P774-01 to –03).:

Protocol	P744 Value
Modbus RTU	8
Modbus ASCII	7 or 8
Dolphin Plus	7 or 8

Note: Use 8 data bits when using port 2.

Values

5 to 8 (*f* = 8)

P775 Stop bits

The number of bits between the data bits for the selected port, ports 1 to 3 P775-01 to -03).

Values

1 or 2 (*f* = 1)

P778 Modem attached

Sets port 1 (P778-01) to use an external modem.

Any connected modem must be set up to auto-answer incoming calls. The SF 500 does not automatically configure the modem.

Autobaud (enabled by P778=1)

When the SF 500 is powered up or the P779 Modem Inactivity Timeout expires three carriage returns are sent to the modem to allow it to set its serial connection to P772 Baud Rate.

If a connection is made with the modem at a different baud rate the SF 500 will attempt to use that rate instead of the P772 value. For troubleshooting purposes the baud rate on the modem can be hard-coded to the rate set on the SF 500. See your modem documentation for information on fixing the baud rate.

Values

0	*f*	no modem connected
1		modem connected

P779 Modem idle time

Sets the time in seconds that the SF 500 will keep the modem connected even though no activity is happening.

To use this parameter ensure that P778=1.

This parameter allows for reconnection to the SF 500 unit after an unexpected disconnect. Ensure that the value is low enough to avoid unnecessary delays when an unexpected disconnect occurs but long enough to avoid timeout while you are still legitimately connected.

Hanging Up

If the line is idle and the P779 Modem Inactivity Timeout expires then the modem is directed to hang up the line. This is done with the Hayes commands:

- two second delay
- +++
- two second delay
- ATH

Ensure that P779 is set longer than the standard polling time of the connected master device.

0 disables the inactivity timer.

Values

0-9999: 0 (*f* = 1)

P780 RS-232 Transmission interval

Note: Applicable only to ports programmed for printer communication (parameter 770).

Sets the interval between transmissions to be applied to the selected port, ports 1 to 3 (P780-01 to –03).

Enter the period in minutes. (*f* = 0)

P781 Data message

Note: Applicable only to ports programmed for printer communication (parameter 770).

Sets the data message to be delivered via the selected port, ports 1 to 3 (P781-01 to -03).

All messages and printouts include time and date.

Entry:

0 = no message[f]
1 = rate
2 = total*
3= rate and total*
4 = batch total (totalizer 5)
5 = quick start parameters (P001 – P017)
6 = all parameters

*totalizer 1 and/or 2 as set by P647, Totalizer Display

P799 Communications Control

Assigns programming control either locally through the keypad or Dolphin Plus® (P770 = 1), or remotely through Modbus protocol (P770 = 2 or 3) or SmartLinx®.

Entry:

0 = local
1 = remote

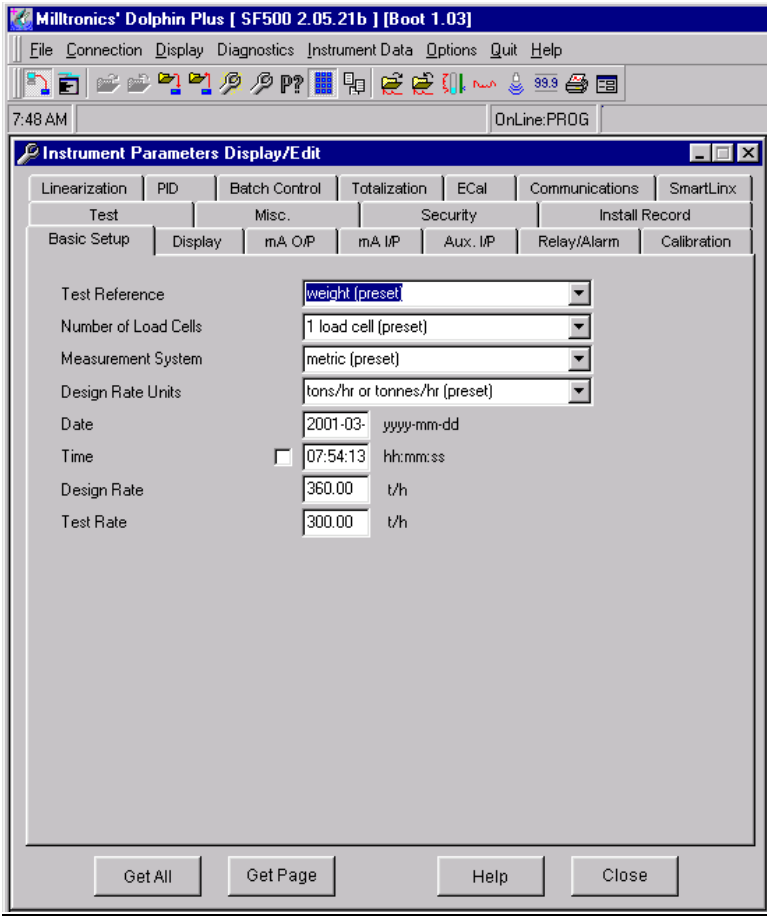
WARNING: When a SmartLinx® card is installed and P799 = 1, the parameters that the SmarlLinx® card is writing to the SF 500 will be continuously updated. Therefore, if you connect a SmartLinx® card to the SF 500, set P799 = 1 and not write anything to the SmarLinx® card, your setpoints will be 0.

Dolphin Protocol

The protocol is available on all communications ports on all units. This protocol is not available for third party use.

The primary use of this protocol is to connect the SF 500 to Siemens Milltronics' Dolphin Plus configuration software.

Dolphin Plus Screen Shot



Modbus RTU/ASCII Protocol

Modbus is an industry standard protocol owned by Schneider Automation Inc.[1] and is used throughout process control industries for communication between devices. Modbus RTU and Modbus ASCII are both master-slave type protocols. SF 500's Modbus is a slave unit.

SF 500 supports both the RTU and ASCII version of Modbus and attempts to automatically detect the type when a connection is made.

A brief description of Modbus RTU and Modbus ASCII is given in this manual. For a full description of the Modbus protocol, contact your local Schneider representative. Also you may try their website at http://www.modicon.com.

Note: Siemens Milltronics does not own the Modbus RTU protocol. All information regarding that protocol is subject to change without notice.

How Modbus Works

As mentioned above, Modbus is a master-slave type protocol. This can also be referred to as a query-response protocol. What both of these terms mean is that on the network, there is one master which requests information from multiple slave devices. The slave devices are not permitted to talk unless they have been asked for information. When responding, the slaves will either give the information that the master has requested or give an error code consisting of why it can not give the information or that it did not understand the request. Refer to *Error Handling* on page 90.

All SF 500 information is mapped into the Modbus holding registers so that Modbus function code 03 can read from them and Modbus function code 06 and 16 can write to them.

Modbus RTU vs. ASCII

There are two main differences between Modbus RTU and Modbus ASCII. The first is that Modbus RTU encodes the message in 8-bit binary, while ASCII encodes the message in ASCII characters. Therefore, one byte of information would be encoded into 8 bits for RTU and into two ASCII characters for ASCII (which would be two 7-bit units). The second difference is that the error checking method is different (see below).

Modbus RTU has the advantage that it has a much greater data throughput than ASCII. Modbus ASCII has the advantage that it allows time intervals of up to one second to occur between characters without causing an error. Either protocol works with the SF 500.

1. Modicon is a registered trademark of Groupe Schneider.

Modbus Format

Note: When using a commercial Modbus driver all of the message details are handled for you.

To give you a better idea of how a Modbus message works, a master on network would send a message in a format similar to this:

Station address	Function code	Information	Error check

Where:

Station address the network address of the slave being accessed

Function Code number that represent a Modbus command, either:
03 read function
06, 16 write functions

Information depends on function code

Error Check Cyclical Redundancy Check (CRC) for RTU and Longitudinal Redundancy Check (LRC) for ASCII

There is more to the frame than is described above, this is shown to give the user a general idea of what is going on. For a full description, refer to the Modbus specifications.

Modbus Register Map

The memory map of the SF 500 occupies the Modbus holding registers (R40,001 and up).

The SF 500 makes it easy for users to get useful information via Modbus. The following chart gives an overview of the different sections.

Register Map for SF 500:

Map Legend	Description
Type	Arbitrary classification of registers.
Description	Brief description or title of associated register.
Start	Provides the starting address for the register(s) where the parameter values are to be read from or written to.
Number R	The number of registers required to read or write the complete parameter value. Where the number of registers (6) are addressed in incrementing sequence from the start register.
Parameter Values	Refer to *Parameter Values*, page 87.
Read	Identifies the read / write capability for the register being addressed.
Reference	Provides reference documentation for the register being addressed.

Type	Description	Start	# R	Parameter Values	Read	Reference
Format	Format Word for 32 bit variables	40,062	1	0 - 1	r/w	see page 80
ID	Device Identifier	40,064	1	2	r	see page 80
Handshaking Area (Parameter Access)	Parameter	40,090	1	0-999	r/w	see page 80
	Primary Index	40,091	1	0 - 9	r/w	
	Secondary Index	40,092	1	0 - 9	r/w	
	Format Word	40,093	1	bit mapped	r/w	
	Read Value (word 1)	40,094	2	32 bits	r	
	Write Value (word 1)	40,096	2	32 bits	r/w	
Date and Time	YYYY	41,000	1	1996-2069	r/w	see P008 page 94 and page 83
	MM	41,001	1	1 - 12	r/w	
	DD	41,002	1	1 - 31	r/w	
	hh	41,003	1	00 - 23	r/w	see P009 page 94 and page 83
	mm	41,004	1	00 - 59	r/w	
	ss	41,005	1	00 - 59	r/w	
	Time Zone	41,006	1	-12 - 12	r/w	see P739 page 114
Process Values	Rate	41,010	2	32 bits	r	see page 84
	Total 1	41,016	2	32 bits	r	
	Total 2	41,018	2	32 bits	r	
	Device State	41,020	1	bit mapped	r	see page 84
	Command Control	41,022	1	bit mapped	r/w	see page 85
	Multi-Span Selection	41,024	1	1 - 8	r/w	see page 38 and P365 on page 104
	Total 1 decimal places	41,025	1	1 - 3	r/w	see page 85
	Total 2 decimal places	41,026	1	1 - 3	r/w	see page 85
	PID 1 Setpoint	41,040	2	32 bits	r/w	see P416 page 109
	PID 2 Setpoint	41,042	2	32 bits	r/w	
	Batch Setpoint	41,044	2	32 bits	r/w	see P564 page 109
	Batch Prewarn Setpoint	41,046	2	32 bits	r/w	see P567 page 110
I/O	Discrete Input	41,070	1	bit mapped	r	see page 86
	Relay Outputs	41,080	1	bit mapped		
	mA Inputs	41,090	2	0000 - 20,000	r	
	mA Outputs	41,110	3	0000 - 20,000	r	
Diagnostic	Diagnostic State	41,200	1	number code	r	see page 95

Type	Description	Start	# R	Parameter Values	Read	Reference
PID Tuning	PID 1 Proportional Term	41,400	2	32 bits	r/w	see P405 page 107
	PID 2 Proportional Term	41,402	2	32 bits	r/w	
	PID 1 Integral Term	41,404	2	32 bits	r/w	see P406 page 108
	PID 2 Integral Term	41,406	2	32 bits	r/w	
	PID 1 Derivative Term	41,408	2	32 bits	r/w	see P407 page 108
	PID 2 Derivative Term	41,410	2	32 bits	r/w	
	PID 1 Feed Forward Term	41,412	2	32 bits	r/w	see P408 page 108
	PID 2 Feed Forward Term	41,414	2	32 bits	r/w	
	PID 1 Remote Setpoint Ratio	41,416	2	32 bits	r/w	see P418 page 109
	PID 2 Remote Setpoint Ratio	41,418	2	32 bits	r/w	

Modbus Register Map (cont'd)

Format (R40,062)

This value determines the format of all unsigned, double-register integers (UINT32), except for those in the direct parameter access.

0 indicates that the most significant byte (MSB) is given first
1 indicates that the least significant byte (LSB) is given first

For more information on this data format see page 87

Device Identifier (R40,064)

This value identifies the Siemens Milltronics device type and is "2" for the SF 500.

Handshaking Area (Parameter Access)

An advanced handshaking area is built into the SF 500. Use it to read and write 32 bit parameters.

Mapping

Parameter Read and Write (40,090 – 40,095) is a series of six registers that are used for reading and writing parameter values to and from the SF 500. The first three registers are always unsigned integers representing parameters and index values. The second three 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	Read value, word 1
40,097	Read value, word 2

Reading Parameters

To read parameters through Modbus follow these steps:

1. Send the parameter, its primary index, and its secondary index (usually 0) and format to registers 40,090, to 40,093.
2. Wait until you can read the above values from the registers (40,090 to 40,093).
3. Read the value from registers 40,094 and 40,095.

Writing Parameters

To set parameters through Modbus follow these steps:

1. Send the parameter, its primary index, and its secondary index (usually 0) to registers 40,090, 40,091, and 40,092.
2. Write the value to registers 40,096 and 40,097
3. Write the desired format word to register 40.093 to enable the SF 500 to interpret the value correctly.

Format Register:

Bits	Values	Description
1 - 8	0 - 2	Error Code
9 - 11	0 - 7	decimal offset*
12	0/1	decimal shift*, Right (0) or Left (1)
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

The bits listed above are in order from least to most significant:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

*__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:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
reserved	most significant first	read	fixed format	decimal offset of +2				no error code							

The value sent to the SF 500 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. Bits 9 to 11 indicate the number of place by which the decimal is to be shifted. Bit 12 indicates the direction by which the decimal point is shifted, left or right. For example, if the decimal offset (value of bits 9 to 11) is '2' and the shift (value of bit 12 is '0'), then the decimal point is shifted two places to the right.

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 SF 500 has two error codes available:

Values	Description
0	No error
1	Data not available as percent (available as units)
2-255	Reserved

Date and Time (R41,000 – 41,006)

The date and time can be read or written in registers 41,000 to 41,006 as defined in the table above.

Example: If you are located in Toronto, Canada and would like to set the date and time to February 14, 1999, 1:30 p.m. and 42 seconds, you would write the following:

Bits	Values
R41,000	1999
R41,001	2
R41,002	14
R41,003	13
R41,004	30
R41,005	42
R41,006	-5

Note: The time zone register is used only as a reference and does not affect the operation of the SF 500.

Process Values (R41,010 – R41,048)

Rate and Total (R41,010 – R41,019)

The associated registers provide the readings of rate. Totalizer 1 and Totalizer 2 in engineering units as displayed in the local SF 500 display.

Device State (41,020 – 41,020)

The Device State word is used to feedback the current operating state of the product. Each bit gives the state of different parts of the product, some mutually exclusive, others are not. The state should be checked to verify any device commands.

Bit #	Description	Bit Clear	Bit Set (1)
1	PID 1 Mode	Manual	Auto
2	PID 1 Freeze	No	Yes
3	PID 1 Setpoint Source	Local	Remote
4	PID 2 Mode	Manual	Auto
5	PID 2 Freeze	No	Yes
6	PID 2 Setpoint Source	Local	Remote
7	Zero	No	In progress
8	Span	No	In progress
9	-	-	-
10	-	-	-
11	-	-	-
12	-	-	-
13	Write Privileges	No	Yes
14	System Configured	Not Configured	Yes
15	Mode	Calibration Mode	RUN Mode
16	Totalizing	Not Totalizing	Totalizing

Command Controls (41,022 – 41,022)

The command control word is used to control the unit. Each bit gives access to a command or state as if the operator was using the keypad.

Bits initiating a command (7-12) must change state in order to cause the command the begin. For example, to reset totalizer 1, Bit 9 must be set to 0, then changed to 1. It can stay set or clear for any period:

Bit #	Description	Bit Clear	Bit Set (1)
1	PID 1 Mode	Manual	Auto
2	PID 1 Freeze	No	Yes
3	PID 1 Setpoint Source	Local	Remote
4	PID 2 Mode	Manual	Auto
5	PID 2 Freeze	No	Yes
6	PID 2 Setpoint Source	Local	Remote
7	Zero	No change	Start
8	Span	No change	Start
9	Reset Totalizer 1	No change	Reset
10	Reset Totalizer 2	No change	Reset
11	Reset Batch Totalizer	No change	Reset
12	Print	-	Print
13	-	-	-
14	-	-	-
15	-	-	-
16	-	-	-

Note: Set parameter P799 for remote control before commanding the SF 500 remotely.

Read/Write (R41,025 – R41,026) Total Decimal Places

Sets the number of decimal places (0-3) being read for Total 1, (words 41,016 and 41,017) and Total 2, (words 41,018 and 41,019).

With 3 decimal places, the largest value that can be read is 2,147,483.648.
With 2 decimal places, the largest value that can be read is 21,474,836.48.
With 1 or 0 decimal places, the largest value that can be read is 100,000,000.

Example: R41,025

Bits 0 and 1 are used to indicate the number of decimal places being read in Total 1, Words 7 and 8.

Bit 15 is used to indicate if the decimal place is too large to read the total value correctly.

If three decimal places are being read in Total 1:

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1

If three decimal places are being read in Total 1, and the value is too large to be read with three decimal places:

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1

I/O (R41,070 – 41,116)

The SF 500 provides I/O in the form of:

- discrete inputs
- relay outputs
- mA inputs*
- mA outputs*

* The standard SF 500 provides only one mA output (0/4 – 20 mA). The inclusion of an optional mA I/O card provides two mA inputs (0/4 – 20 mA) and two additional mA outputs.

For the I/O, the assigned registers represent the logic status (e.g. open or closed) of the I/O as configured. Discrete inputs are configured via P270, auxiliary input function; while relay outputs are configured via P100, relay function.

The I/O are mapped into the respective input and output registers, R41,070 and R41,080, as follows:

R41,070		R41,080	
Input	**Bit**	**Output**	**Bit**
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5

For the mA I/O, the assigned registers represent the mA level (e.g. 0 to 20 mA) of the I/O as registered in P911 and P914, mA output test (output value) and mA input value.

The mA I/O are mapped into the respective input and output registers:

Input	Register	Output	Register
1	R41,090	1	R41,110
2	R41,091	2	R41,111
		3	R41,112

For 0 to 20 mA I/O, the register value ranges from 0 to 20,000. For 4 to 20 mA I/O, the register value ranges from 4,000 to 20,000. If the 4 or 20 mA values have been trimmed,

then the register value is adjusted accordingly; e.g. an I/O value of 22 mA would be registered as 22,000.

Diagnostic (R41,200)

Refer to *Troubleshooting* on page 118.

PID Tuning (R41,400 – 41,419)

For SF 500 set up for PID control, several registers have been provided for tuning. Refer to *PID Control* on page 53 and the associated parameters as listed in the register map.

Note: Before you can change any of the setpoints, P799 must be set for remote control.

Parameter Values

Bit Mapped

Bits are packed into registers in groups of 16 bits (1 word). In this manual we number the bits from 1 to 16, with bit 1 being the least significant bit and bit 16 referring to the most significant bit.

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
MSB															LSB

32 Bit

Large numbers are put into unsigned 32 bit integers with a fixed decimal place of three. For example, a value of '7345' represents a value in the SF 500 '7.345'. The default word order is that the first word is the most significant word (MSW) and the second word (register) is the least significant word (LSW).

For example, if we read R41,431 as a 32-bit, the 32 bits would look like the following:

R41,431		R41,432	
16	MSB 1	16 LSB	1
32	32-bit integer value (UNINT32)		1

The whole is read as a 32-bit integer.

To accommodate some Modbus drivers, the most significant byte (MSB) and least significant byte (LSB) can be reversed. See Format Word for SF 500 on page 80 for details.

Text Messages

If a Siemens Milltronics device parameter returns a text message, that message is converted to a number and provided in the register. The numbers are shown in the table below:

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	shrt
30008	pass
30009	fail
30010	hold
30012	hi
30013	de
30014	en
-32768	value is less than -20,000
32767	value is greater than 20,000

Modems

The SF 500 has been successfully connected to several different modems. In general, the Modbus protocol is a very modem friendly protocol. This section gives some general guidelines on modems and their connection. For detailed information, see the modem documentation.

Picking Modems

There are several different types of modems; dial-up, leased line, radio-link, fiber-optic to name the most common.

Dial-up

uses a standard analog phone line and dials the number of the receiving modem.

Lease line

come in either 2 or 4 wire types and use special phone lines that are 'leased' from your phone company (or you) and do not require any dialing.

Radio-link

come in many different types, but all use radio frequencies for transmitting the information.

Fiber-optic

uses a fiber-optic line to connect the two modems.

Each type of modem and each model have various characteristics. Before purchasing the modem contact the modem manufacturer and ask if they have had experience using the modems with Modbus protocol with no flow control. If they have, ask them what settings were required.

Setting up the Modems

Configure modems using software, dip switches, jumpers or a combination. Dip switches are normally located at the back of the modem, jumpers are normally located on the motherboard and require that you remove the cover. Software normally requires you to use a standard terminal program and to connect to the RS-232 port on the modem and send special commands. The most popular command set is called the AT, or Hayse, command set.

For a typical dial-up modem, try the following setup as a first attempt:

Master

Modem

- auto answer off (dip switch?)
- load factory default (dip switch?)
- no flow control (dip switch?)
- baud rate = 9600
- 10 data bits (probably the default)

Modbus RTU Software

- baud rate = 9600
- 8 bit
- no parity
- 1 stop bit
- dial prefix: ATDT
- Initialization command: ATE0Q0V1X05=0512=100
- Reset command: ATZ
- Hang-up command: ATH0
- Command response delay: 5 seconds
- Answer Delay: 30 seconds
- Inter-character delay: 55 ms

Slave

Modem

- auto answer on (dip switch)
- load factory default (dip switch)
- no flow control (dip switch)
- baud rate = 9600
- 10 data bits (probably the default)

SF 500

- set P770, port 1, to the value 3 (Modbus RTU)
- set P771, port 1, to the value 1 (Network ID 1)
- set P772, port 1, to the value 3 (Baud rate of 9600)
- set P773, port 1, to the value 0 (No Parity)
- set P774, port 1, to the value 8 (8 Data Bits)
- set P775, port 1, to the value 1 (1 Stop Bit)
- set P778, port 1, to the value 1 (Communications through Modem)
- set P779, port 1, to the value 300 (Modem Inactivity of 300 seconds)

Note: Parameters are defined in the Installation section (page 6).

Error Handling

Modbus Responses

When polled by a Modbus Master, a slave device will do one of the following:

1. **Not reply.**
   This means that something went wrong with the transmission of the message.
2. **Echo back the command with the correct response.**
   This is the normal response. (see the Modbus specifications for more details).
3. **Return an Exception Code.**
   This reflects an error in the message.

SF 500 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 allowable address for the slave.
03	Illegal Data Value	A value contained in the query data filed is not an allowable value of the salve.
04	Slave Device Failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	Acknowledge	The slave has accepted a request and is processing it, but a long duration of time is required.
06	Slave Device Busy	The slave is processing a long-duration program command.
08	Memory Parity Error	The slave attempted to read extended memory, but detected a parity error in the memory. Service may be required on the slave.

Error Handling

Errors can be divided up into two general sources. Either:

1. There is an error in transmission
   or
2. The user tries to do something that is not a valid action

In the first case, the SF 500 will, not respond and let the master wait for a **response time out** error, which will cause the master to re-send the message.

In the second case, it depends on what the user tries to do. Listed below are various actions and what the expected outcome is. In general, SF 500 will not give an error to the user request.

- If the user reads an invalid parameter, the user will get a number back.
- If the user writes an invalid parameter (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 user 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 the user attempts to write one or more registers that are out of range, an exception response code 2 will be generated.
- If using an unsupported function code, undocumented results may occur. The user is encouraged not to do this.

f indicates factory set value

P000 Security Lock

Locks out the program editor so that parameter values for P001 through P999 cannot be changed. This however does not prevent the access to the parameters for viewing.

Programming is locked out if the value of P000 is other than 1954.

Entry:

1954 = unlocked*f*
~~1954~~ = locked

Start Up (P001 to P017)

This is the minimum parameter programming required before attempting a calibration and successful entry into the RUN mode.

P001 Language

Selects the language for communication with the SF 500

Entry:

1 = english*f*

Note: This manual only lists English as a choice of language. However, your SF 500 will list the additional languages of choice, as the translated software is made available.

P002 Test Reference Selection

Selects the type of test reference used to represent a material rate: weight or electronic.

weight: the weight that is supplied specific to the flowmeter

electronic: calibration based on automatic calculation of the mV span from the load cells or LVDT

Entry:

1 = weight[f]
3 = ECal

P003 Number of Load Cells

Siemens Milltronics flowmeters are available in models of one or two load cell design. Select the number of load cells corresponding to the flowmeter connected.

If using the optional remote LVDT conditioner card, for LVDT based scales, select the "1" value.

Entry:

Enter the number of load cells: 1[f] or 2.

P004 Rate Measurement System

Selects system of measurement used, either imperial or metric.

Entry:

1 = imperial
2 = metric[f]

P005 Design Rate Units

Determines the units for programming and measurement.

		imperial - P004 = 1	metric - P004 = 2
entry:	1[f] =	T/h (tons / hour)	t/h (tonnes / hour)
	2 =	LT/h (long tons / hour)	kg/h (kilograms / hour)
	3 =	lb/h (pound / hour)	kg/min (kilograms / minute)
	4 =	lb/min (pounds / minute)	

Changing this parameter does not affect the rate parameter (P011). This parameter should be re-entered for conformity in units.

t = 1000 kg
LT= 2240 lb.
T= 2000 lb.

P008 Date

Enter the current date in *yyyy-mm-dd* format.

Where:

yyyy = year
mm = month, 01 –12
dd = day, 01 – 31

e.g. 1999-03-19 (March 19, 1999)

P009 Time

Enter the current time in *hh-mm-ss*, 24 hour format.

Where:

hh = hour
mm = minute
ss = second

P011 Design Rate

Specifies the design rate of material flow for the flowmeter. (*f* = 0.00)

Enter the design rate from the supplied design data sheet, in the units selected (P005).

P017 Test Load

The rate referenced when performing a span. (*f* = 0.00)

Enter the test rate value as shown in the corresponding solid flowmeter instruction manual.

P019 Manual Span Adjust

Provides a means for adjustment to the span calibration. (*f* = 0)

The adjustment value is determined by performing material tests and is subsequently entered either as a calculation of % change into P598, or as the weight of the material test.

Entry:

1 = % change
2 = material test

Refer to *Recalibration* on page 30.

P080 Damping Display

Sets the speed at which the displayed rate readings and outputs (alarm and mA) react to the change. The higher the damping value, the slower the response is. Refer to *Operation* on page 49.

Note: The effect of damping (P080-01) on mA output* can be overridden by mA output damping (P220).

The higher the damping value, the slower the response.

Enter damping value, range 0.000[f] – 999

*Damping is not applicable to the mA output if programmed for PID function (P201 = 2).

P081 Display Scroll Mode

The **RUN** displays are scrolled either manually by pressing ALT DISP if the scroll mode is set to OFF, or automatically if the mode is set to on.

Entry:

0 = OFF[f]
1 = ON

Relay/Alarm Function (P100 - P117)

These parameters are specific to the use of the relay/alarm function. Refer to *Operation* on page 49.

P100 Relay Function

Sets the relay function for the relay selected, relays 1 to 5 (P100 -01 to -05)

Entry:

0 = OFF[f]
1 = rate
2 = diagnostic
3 = PID-01 setpoint deviation*
4 = PID-02 setpoint deviation*
5 = pre-warn
6 = setpoint[τ]
7 = on-line calibration**

* valid only if PID system (P400) is enabled.

[τ] valid only if batch function (P560) is enabled.

** valid only if on-line calibration (P355) is enabled.

Note:
- To reset the Diagnostics relay, the SF 500 must be cycled between PROGRAM and RUN mode
- To reset the Batch relays, the Batch totalizer must be reset.

P101 High Alarm / Deviation Alarm

High Alarm (*f* = 100)

For relay functions P100 = 1: this parameter sets the high alarm setpoint for the relay selected, relays 1 to 5 (P100 -01 to -05).

Enter the value in % of full scale.

Deviation Alarm (*f* = 10)

For relay functions, P100 =3 and 4, this parameter sets the deviation setpoint for the relay selected, relays 1 to 5 (P100 -01 to -05).

Enter the value in % of setpoint.

P102 Low Alarm

Sets the low alarm setpoint for relay selected, relays 1 to 5 (P100 - 01 to – 05). (*f* = 20)

Enter the value in % of full scale

Note: Not applicable if P100 = 2, 3, 4, 5, 6 or 7.

P107 Relay Alarms

Sets the alarm mode for the relay selected, relays 1 to 5 (P100 - 01 to - 05.

Entry:

1 = high and low*f*
2 = high only
3 = low only

Note: Not applicable if P100 = 2, 3, 4, 5, 6 or 7.

P117 Relay Dead Band

Sets the dead band for the relay selected, relays 1 to 5 (P100 - 01 to – 05). The dead band prevents relay chatter due to fluctuations at the high or low setpoint. (*f* = 3.0)

Enter the value in % of full scale, or for deviation alarm enter % of setpoint.

Note: Not applicable if P100 = 2, 5or 6.

P118 Relay Logic

Sets the logic applied to relays to determine their open or closed state.

Power Failure

The relays on the SF 500 default to normally open under power loss.

Normal Operation

In software, all relays are programmed the same way; with **ON** setpoints always indicating relay action. This parameter allows the reversal of the operation. Normally, P118 = 2 for each relay.

Reverse Operation

When P118 = 3, the operation of the indexed relay is reverse from normal.

Values

P118	Logic	Relay
2	positive logic	normally closed[f]
3	negative logic	normally open

P119 Relay Override

This function allows the user to simulate an alarm condition: ON or OFF, which will override normal operation until P119 setting is returned to normal.

Values

P119	Condition	Display (alarm field)
0	normal	normal
1	alarm on	ALM #
2	alarm off	blank

mA I/O Parameters (P200 - P220)

These parameters are specific to the use of the mA output. Refer to m*A Output* on page 49 for details.

- mA output 1 is physically located at terminals 21/22 on the main board
- mA outputs 2 and 3, and inputs 1 and 2 are physically located on the optional mA I/O board which is mounted onto the main board.

In the case of assigning mA input and output functions to PID control, the following correlation exists:

	mA input	mA output
PID control 1	1	2
PID control 2	2	3

P200 mA Output Range

Sets the mA range for the output selected, outputs 1 to 3 (P200 - 01 to - 03).

Entry:

1 = 0 - 20 mA
2 = 4 - 20 mA[f]

P201 mA Output Function

Assigns the mA output function for the output selected, outputs 1 to 3 (P201 - 01 to - 03)

Entry:

1 = rate[f]
2 = PID control output*

* valid for outputs 2 and 3, only if PID system (P400) is enabled

P204 mA Output Average

Sets the averaging period, in seconds, for the rate output for output 1 only.

The instantaneous mA values are averaged for the set period, and then the average value is output during the next period while a new average is being calculated.

Entry:

0 = OFF[f]
1 – 999 = averaging period

P212 mA Output Minimum

Sets the minimum mA limit for the output selected, outputs 1 to 3 (P212 - 01 to - 03). The limit sets the lower mA range (0 or 4 mA) to a minimum output value. (*f*= 3.80)

Enter limit value, range 0 - 22

P213 mA Output Maximum

Sets the maximum mA limit for the output selected, outputs 1 to 3 (P213 - 01 to - 03). The limit sets the upper mA range (20 mA) to a maximum output value. (*f*= 22.00)

Enter limit value, range 0 - 22.

P214 4 mA Output Trim

Trims the 4 mA output level for the output selected, outputs 1 to 3 (P214 - 01 to – 03). The trim adjust the output to agree with a milliameter or other external mA input device.

Scroll the trim value up or down

P215 20 mA Output Trim

Trims the 20 mA output level for the output selected, outputs 1 to 3 (P215 - 01 to - 03). The trim adjust the output to agree with a milliammeter or other external mA input device.

Scroll the trim value up or down

P220 mA Output Damping

Sets the damping for the output selected, outputs 1 to 3 (P220 - 01 to - 03). Damping sets the speed at which the mA output reacts to change. The greater the damping value, the slower the response. If the value is 0, the mA output assumes the damping set in P080. (*f*= 0.00)

Enter the damping value, range 0.001 – 999

P250 mA input range

Sets the mA range for the input selected, inputs 1 to 2 (P250 - 01 to - 02).

Entry:

1 = 0 - 20 mA
2 = 4 - 20 mA*f*

P255 mA Input Function

Assigns the mA input function for the input selected, inputs 1 to 2 (P250 - 01 to - 02)

Entry:

0 = OFF[f]
1 = PID setpoint
2 = PID process variable
3 = On-line calibration*

* valid only if On-line Calibration is turned on, (P355 = 1).

P261 4 mA Input Trim

Trims the 4 mA input level for the input selected, inputs 1 to 2 (P250 - 01 to - 02). The trim adjusts the input to agree with an external 4 mA source.

Follow the SF 500 on line instructions to trim the input.

P262 20 mA Input Trim

Trims the 20 mA input level for the input selected, inputs 1 to 2 (P250 - 01 to - 02). The trim adjust the input to agree with an external 20 mA source.

Follow the SF 500 on line instructions to trim the input.

P270 Auxiliary Input Function

Selects the auxiliary input function for the input selected; inputs 1 to 5 (P270 - 01 to - 15).

Value	Function	Symbol	Description
0	OFF		
1	alternate display:		momentary closure of the input contact causes the RUN display to scroll to the next display. ALT DISP
2	reset totalizer 1:		momentary closure of the input contact resets the totalizer. RESET TOTAL
3	zero:		momentary closure of the input contact initiates a zero calibration. ZERO
4	span:		momentary closure of the input contact initiates a span calibration. SPAN
5	print:		momentary closure of the input contact sends a print request.
6	multispan selection:		contact states selects the multispan (P365)*.

Value	Function	Symbol	Description
8	reset batch:		momentary closure of the input contact resets the batch totalizer to zero.
9	PID freeze:		off closure suspends PID function in the auto mode freeze function in the auto mode and holds output at last value
10	PID setpoint source:		remote local
11	PID mode:		auto manual
12	external alarm:		the input contacts status is sensed off
13	remote communication write:		keypad / Dolphin Plus write (program) enabled SmartLinx® / remote device write (program) enabled
14	initiate on-line calibration:		momentary closure of the input contact initiates on-line calibration
15	accept new on-line calibration span:		momentary closure of the input contact accepts the on-line calibration deviation

Notes:

- A remote Span performs a zero function, and requires the user to set up a span test. Once the test weight is within +/-2% of the design test rate, a span is performed.
- To use the Print command, run the SF 500 in **RUN** mode.
- Before you can use On-line Calibration, P100,P255, P355, P356, and P357 must be set up.

Entry:

0 = OFF
1 = alternate display
2 = reset totalizer 1
3 = zero
4 = span
5 = print
6 = multispan selection *
7 = reserved
8 = reset batch

9 = PID freeze
10 = PID setpoint source
11 = PID mode
12 = external alarm
13 = remote communication write
14 = Initiate On-line Calibration
15 = Accept new on-line calibration span**

Multispan selection	Auxiliary Input 1	Auxiliary Input 2	Auxiliary Input 3
1	⊣⊢	⊣⊢	⊣⊢
2	⊣/⊢	⊣⊢	⊣⊢
3	⊣⊢	⊣/⊢	⊣⊢
4	⊣/⊢	⊣/⊢	⊣⊢
5	⊣⊢	⊣⊢	⊣/⊢
6	⊣/⊢	⊣⊢	⊣/⊢
7	⊣⊢	⊣/⊢	⊣/⊢
8	⊣/⊢	⊣/⊢	⊣/⊢

*If the SF 500 is programmed for multispan operation, the auxiliary input contact state determines the multispan number (equivalent to P365). Input 1 is reserved for multispan 1 and 2 selection. Input 2 is reserved for multispan 3 and 4 selection, and Input 3 for 5 to 8.

** Enter **1** (existing ALT_DSP) to reject the new on-line calibration span.

Calibration Parameters (P295 – 360)

P295 Load Cell Balancing

Initiates an electronic balancing of the load cell input signals. Balancing is required for flowmeter models of two-load cell design.

Refer to *Start Up* on page 23 for requirements and execution.

P341 Days Of Service

The cumulative days that the application device has been in service. The time is recorded once daily in a non-resetable counter. Periods of less than 24 hours. are not recorded, nor accumulated. (*f* = 0)

P350 Calibration Security

Provides additional security to the global lock (P000).

		zero	span	Reset T1
entry:	0 = no additional security.*f*	Yes	Yes	Yes
	1 = in addition to P000 lock; no span.	Yes	No	Yes
	2 = in addition to P000; no zero, no span.	No	No	Yes
	3 = in addition to P000; no zero, no span, no totalizer 1 (T1) reset.	No	No	No

Note: If SW1 is set to the left position, it will only allow the Zero function.

On-line Calibration Options (P355 to P358)

Note: On-line calibration options must be enabled (P355 = 1) before they become available.

P355 On-line Calibration Feature

Enables On-line Calibration.

Entry:

0 = OFF*f*
1 = ON

P356 On-line Calibration Reference Weight

Enter the weigh bin reference weight, (in units selected in P005), range 0.000 to 99999. (*f* = 0.000)

P357 On-line Calibration Limits

Used to enter the weigh bin limit settings.

P357.1 MAX LIMIT, range 0.0 to 100.0 (*f* = 0%)
P357.2 HIGH LIMIT, range 0.0 to 100.0 (*f* = 0%)
P357.3 LOW LIMIT, range 0.0 to 100.0 (*f* = 0%)

P358 On-line Calibration Activation

Initiates on-line calibration.

Entry:

0 = OFF[f]
1 = ON

P359 Factoring

Factoring is used as a method of calculating the value of the test rate (P017) to a new test reference. The task is performed only for the weight relevant for the multispan selected, if applicable.

Entry:

1 = weight (*f* = 1)
Refer to *Recalibration* on page 30 for execution of the factoring procedure.

Note: Totalization is halted during the factoring procedure, and resumed only upon return to the RUN mode.

P360 Calibration Duration

Sets the number of whole calibration durations used during a zero or span calibration. (*f* = 1 which is approximately 20 seconds.)

Enter number of time periods, range 1 to – 99.

P365 Multispan

Select the span reference to be applied for determination of rate and totalization.

Entry:

1 = multispan 1 (MS1), for product or condition A[f]
2 = multispan 2 (MS2), for product or condition B
3 = multispan 3 (MS3), for product or condition C
4 = multispan 4 (MS4), for product or condition D
5 = multispan 5 (MS5), for product or condition E
6 = multispan 6 (MS6), for product or condition F
7 = multispan 7 (MS7), for product or condition G
8 = multispan 8 (MS8), for product or condition H

Refer to *Multispan* on page 38 and *P270 Auxiliary Input Function* (6) on page 100.

P367 Direct Zero Entry

Directly enters the zero reference count.

Direct entry is intended for use when replacing software or hardware and it is not convenient to perform an initial zero at that time. (*f* = 0)

Refer to *Recalibration* on page 30 for execution.

P368 Direct Span Entry

Directly enters the span reference count for the span selected, span 1 to 8 (P368-01 to -08).

Direct entry is intended for use when replacing software or hardware and it is not convenient to perform an initial zero at that time. (*f* = 0)

Refer to *Recalibration* on page 30 for execution.

P370 Zero Limit Deviation %

Sets the zero calibration deviation limit (±) from the last initial zero. If the accumulated deviation of successive zero calibrations exceeds the limit, the zero calibration is aborted. (*f* = 12.5)

Enter the maximum allowable % deviation.

P377 Initial Zero

Resets the initial zero.

The initial zero is the reference zero to which all subsequent operator initiated zero calibrations are compared in determining whether they have deviated beyond the zero limit (P370). (*f* = 1)

Note: Refer to *Initial Zero* on page 34 for execution.

P388 Initial Span

Resets the initial span for the span selected, multispan 1 to 8 (P388-01 to –08).

The initial span is the reference to which all subsequent span calibrations are compared in determining whether they have deviated beyond an accumulated ±12.5% of the initial span. (*f* = 1)

Note: Refer to *Initial Span* on page 37 for execution.

Linearization Parameters (P390 - P392)

These parameters are used to compensate for non-linear response of the weighing system to the SF 500. Refer to *Linearization* on page 46 for execution, and example on the use of these parameters.

Note: In the case of multispan operation, the linearizer is applied to all spans.

P390 Linearizer

Enables or disables the linearization function.

Entry:

0 = OFF[f]
1 = ON

P391 Linearizer Load Points

Enters the rate values, in units of P017, for the point selected, points 1 to 5 (P391-01 to –05). (*f* = 0.00)

P392 Linearizer Compensation %

Enters the compensation value, in percent, for the point selected, point 1 to 5 (P392-01 to – 05). (*f* = 0.00)

P398 Moisture Content

Factors out moisture component of rate and total for all multispans selected. The factored values are meant to report the dry mean values of the material being conveyed. (*f* = 0.00)

Enter the moisture content in % weight.

Proportional Integral Derivative (PID) Control Parameters (P400 – P419)

Note:

- Changes to P401, P402, and P414 are not immediately effected while in auto mode. Change should be made in the manual mode and are effected upon return to the auto mode.
- The PID function does not control during any of the calibration functions (e.g. zero, span, factor, material test).

P400 PID System

Enables the selected PID system, systems 1 or 2 (P400 – 01 or – 02).

Entry:

0 = OFF[f]
1 = manual
2 = auto

P401 PID Update Time

Sets the update time (P401 – 01 or -02) for the corresponding PID system (1 or 2).

Normally the controller is updated each time the process value is updated (every 300 ms). However in unstable or slow reacting systems the controller update can be programmed to update on a multiple of the process value update. A high value can introduce instability. (*f* = 1)

Entry:

1 = 300 ms
2 = 600 ms
3 = 900 ms
etc.

P402 PID Process Value Source

Determines the source of the process value (P402 – 01 or – 02) for the corresponding PID system (1 or 2)

The process value is the value that the controller is trying to match with the setpoint. (*f* = 1)

Enter:

1 = rate[f]
2 = mA input 1
3 = mA input 2

P405 Proportional Term

Sets the proportional term (P405-01 or -02) for the corresponding PID system (1 or 2). (*f* = 0.400)

The proportional term is the proportional gain. A gain of 1 is equivalent to a proportional band of 100%.

The proportional band is the range of deviation from the setpoint that corresponds to the full range or the control output.

Enter the proportional term 0.000 to 2.000.

P406 Integral Term

Sets the integral term (P406-01 or -02) for the corresponding PID system (1 or 2). (*f*= 0.200)

Enter the integral term 0.000 to 2.000.

P407 Derivative Term

Sets the derivative term (P407-01 or -02) for the corresponding PID system (1 or 2). (f = 0.050)

Enter the derivative term 0.000 to 1.000.

P408 Feed Forward Term

Sets the feed forward term (P408-01 or -02) for the corresponding PID system (1 or 2). (*f*= 0.300)

Enter the feed forward term 0.000 to 1.000.

P410 Manual Mode Output

Displays the percentage output value (P410-01 or -02) for the corresponding PID system (1 or 2).

When the PID system is in manual, this is the value output, providing bumpless transfer when switching from manual to auto. When switching from auto to manual, this parameter is loaded with the current controlled value.

P414 Setpoint Configuration

Configures the setpoint (P414-01 or -02) for the corresponding PID system (1 or 2).

Determines the source for the PID's setpoint. If local, the setpoint value is entered into P415. The setpoint can be set from the mA input 1 or 2. The mA value is scaled to the full scale value of the process value (P402).

Entry:

0 = local*f*
1 = mA input 1*
2 = mA input 2*
3 = % rate**

* for PID-01, the setpoint source is mA input 1; for PID-02, the setpoint source is mA input 2.

** Option 3 is only available if P402 has been set for an external process value source. The setpoint will be the current rate value displayed as a percentage.

P415 Local Set Point Value

Sets the local set point (P415-01 / 02), in engineering units, for the corresponding PID system (1 or 2) when in auto mode. For the external process variable, the set point is shown is %. (*f* = 0.000)

P416 External Setpoint

Displays the external setpoint (P416-01 / 02), in engineering units, for the corresponding PID system (1 or 2). For the external process variable, the setpoint is shown in %.

If the setpoint is external (P414 = 1 or 2), then this parameter displays the setpoint value that is being input, either mA input 1 or 2.

P418 Remote Setpoint Ratio

Sets the remote setpoint ratio (P418 –01/02) for the corresponding PID system (1 or 2) when P414 = 1 or 2. (*f* = 100)

The remote setpoint ratio scales remote setpoint input by the set percentage. A value of 100 means that the setpoint is 100% of the mA input.

Batch Control (P560 – P568)

The following parameters are specific to the use of the SF 500 as a batch controller. P564-P568 is accessible only when Count Up (1) is selected.

P560 Batch Mode Control

Enables the batch control function. Batch control is count up.

Entry:

0 = OFF*f*
1 = count up

P564 Batch Setpoint

Sets the batch total. When the amount of material delivered reaches this point, the batch relay contact opens (P100) to signal the end of the batch. (*f* = 0.000)

Enter the setpoint of the units of weight selected (P005).

P566 Batch Pre-Warn

Enables or disables the pre-warn function associated with batch control, warning that the batch is nearing completion.

Entry:

0 =OFF*f*
1 = ON

P567 Batch Pre-Warn Setpoint

Sets the setpoint for the pre-warn function (P566). When the batch reaches the setpoint, the relay contact associated with the pre-warn function (P100) closes. (*f*= 0.000)

Enter setpoint in units of weight selected (P005).

P568 Batch Pre-Act

Acts on the batch operation such that when the batch totalizer is reset, the batch total is compared to the setpoint (P564). The difference is then applied to pre-act on the setpoint for the next batch in order to improve the accuracy of the batch. The activity is internally limited to ±10% of the batch setpoint

e.g. For Auto Batch Pre-Act

	1st batch	2nd batch	3rd batch
setpoint	1000	1000	1000
pre-act	1000	950	960
total	1050	990	1000

Entry:

0 = OFF*f*
1 = Auto
2 = Manual

P569 Manual Batch Pre-Act Amount

Accessible only though Batch Pre-Act (P568), when Manual (2) is selected.

Manual

Enter a value to make the setpoint relay change status before reaching the setpoint. This allows the feeding system to empty with each batch. The value of the manual pre-Act entry is generally reflective of the material that is left in the feeding system.

Example:

Setpoint = 1000
Manual Pre-Act = 20
The gate shuts off at 980. The batch value of 1000 is met as feeding system empties.

P598 Span Adjust Percentage

Accessible only through manual span adjust (P019), when percent change (1) is selected.

Refer to *% Change* on page 30.

Totalization (P619 - P648)

The following parameters are specific to the use to the SF 500 totalizers. Refer also to *Operation / Totalization* on page 51.

P619 Totalling Dropout

This parameter sets the limit, in percent of design rate, below which material rates are not totalized. (*f* = 3.0)

The value of **0** is reserved to allow both negative and positive totalization.

Enter drop out value in % of design rate.

P631 Totalizer Resolution

This parameter sets the resolution of the totalizer selected.

Totalizers are:

-01, totalizer 1
-02, totalizer 2
-03, verification totalizer
-04, material test totalizer
-05, batch totalizer

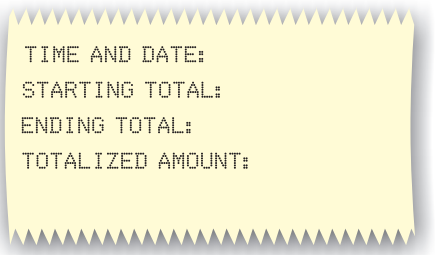
Entry:

1 = 0.001 (one thousandth)
2 = 0.01 (one hundredth)
3 = 0.1 (one tenth)
4 = 1 (unit)^{f}
5 = 10 (x ten)
6 = 100 (x hundred)
7 = 1000 (x thousand)

P635 Verification Totalizer

Enables a dedicated internal totalizer that totals the amount of material conveyed during a zero or span verification. It is used to verify the accuracy of the scale.

If a printer is connected to a port and the required programming is in order, a printout of the activity is automatically done on completion of the verification process.



Entry:

0 = OFF, verification totalizer disabled[f]
1 = do not total, verification totalizer is enabled, but main totalizers* are disabled
2 = add total, verification totalizer is enabled as well as main totalizers*
*main totalizers consist of internal totalizers 1 and 2, and external totalizers 1 and 2.

P638 External Totalizer Resolution

Note: If the resolution selected would cause the totalizer to lag behind the count at 100% of design rate, the next possible resolution is automatically entered.

This parameter sets the resolution of the selected external totalizer.

Totalizers are:

P638-01, external totalizer 1 (T1), terminals 35/36
P638-02, external totalizer 2 (T2), terminals 38/39

Entry:

1 = 0.001 (one thousandth)
2 = 0.01 (one hundredth)
3 = 0.1 (one tenth)
4 = 1 (unit)[f]
5 = 10 (x ten)
6 = 100 (x hundred)
7 = 1000 (x thousand)

P643 External Contact Closure

Sets the duration of the contact closure, in ms, for the external totalizer selected, totalizers 1 and 2 (P643-01 or -02). (*f* = 30)

Permissible values are in 10 ms increments from 0 to 300 ms. The value is automatically calculated upon entry of P11 (design rate) and P638 (totalizer 1 resolution, external) so that the duration of contact closure allows the transistor switch response to track the total, up to 150% of the design rate. The value can be changed to suit specific contact closure requirements, such as in the case of programmable logic controllers.

Note: If the duration selected causes the totalizer to lag behind the count rate, the next possible duration is automatically entered.

P647 Totalizer Display

Selects the totalizer combination to be displayed, either manually through the scroll display key or automatically by control of the display mode (P081).

Entry:

1 = totalizer 1*f*
2 = totalizer 2
3 = totalizer 1 and 2

P648 Totalizer Reset, Internal

Manual reset of the selected internal totalizer when the entry is made. (*f* = 0)

Entry:

0 = no reset
1 = reset totalizer 2
2 = reset totalizers 1 and 2
Resetting the internal totalizers 1 and 2 resets the internal registers for external totalizers 1 and 2.

P699 ECal mV Span

This parameter becomes available when Ecal is selected in P002.

Enter the mV span corresponding to 0 to 100% full scale rate. The display changes to P017 to show the design rate value as the test rate.

P735 Back Light

Sets the intensity of the back light for the LCD. (*f* = 10)

Entry:

0 = OFF
1 to 10 = low to high

P739 Time Zone

The offset from Greenwich mean time (GMT) of local time.

This parameter does not affect any timed events because all times are local. It can be accessed by a remote computer for synchronization purposes.

Enter local time zone –12 to 12

Communication (P750 - P799)

These parameters cover the various communications formats supported by the SF 500: serial printer, Dolphin Plus, SmartLinx®, and Modbus.

P750 – P769 SmartLinx® Module Specific Parameters

These parameters are specific to the SmartLinx® module installed. Refer to the module documentation for a list and description of the specific parameter requirements.

P770 – P789 Local Port Parameters

These parameters are specific to programming of the SF 500 communication ports. Refer to *Communications* on page 69 for a listing and description of these parameters.

P790 SmartLinx® Error Status

Displays the results of ongoing hardware tests within the communications circuitry. If any test does not meet the PASS requirements, communication halts and tests are repeated until PASS requirements are met. Communication then resumes.

P791 Bus Error

Indicates if an error condition is occurring on the bus.

Values		Description
0	*	no error
Error Code		refer to the SmartLinx module documentation for explanation of the code.

P792 SmartLinx® Error Count

Displays the number or errors.

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 SmartLinx® 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 SmartLinx® manual for a full description of this parameter.

P799 Communications Control

Assigns programming control through the local keypad (or Dolphin Plus, P770 = 1), or through a Modbus protocol (P770 = 2 or 3)

Entry:

0 = local
1 = modbus

Test and Diagnostic (P900 - P951)

Note: These parameters are used for test and diagnostic purposes.

P900 Software Revision

Displays the EPROM (Flash ROM) software revision level.

P901 Memory Test

Tests the memory. Test is initiated by scrolling to the parameter or repeated by 'pressing enter'

Display:

PASS = normal
FAIL = consult Siemens Milltronics.

P911 mA Output Test

Tests the mA output value for the output selected, outputs 1 to 3 (P911 -01 to -03)

Displays the value from the previous measurement. Enter a test value and the displayed value is transmitted to the output. Upon returning to the RUN mode, the parameter assumes the actual mA output level. (*f* = 0)

Use the  and to scroll the value

P914 mA Input Value

Displays the current mA input value for the input selected, inputs 1 to 2 (P914 – 01 to -02).

Note: Not applicable if mA I/O board is not connected.

P940 Load Cell mV Signal Test

Displays the raw (unbalanced) mV signal input for the selected load cell, load cells A to B (P940 – 01 to – 02)

Range 0.00 - 50.00 mV.

P943 Load Cell A/D Reference

Displays the A/D reference value for the selected load cells. These values are affected by load cell balancing (P295).

Load cells are:

– 01 = A and B
– 02 = A
– 03 = B

Note: When using an LVDT it is displayed as input A.

P948 Error Log

Displays a log of the last 25 error or alarm events (P948 – 01 to – 25) that have occurred. Event 01 is the current error.

Display:

0 = no error
# = error code; refer to *Troubleshooting* on page 118

P949 Diagnostic Error Testing

Enables or disables diagnostic error checking for memory, load cell LVDT conditioning card signals. (*f* = 0)

Entry:

0 = disable
1 = enable

Refer to *Troubleshooting* on page 118.

P950 Zero Register

Registers the number of zero calibrations that have been done since the last master reset. (*f* = 0)

P951 Span Register

Registers the number of span calibrations for the span selected, span 1 to 8 (P951 - 01 to - 08), that have been done since the last master reset. (*f* = 0)

P999 Master Reset

Resets parameters and totalizers to their factory setting. (*f* = 0)

Enter **9** to execute the reset.

Common Problems Chart

Symptom	Cause	Action
When trying to set the Siemens Milltronics device parameter, the parameter remains unchanged.	External Error	Use keypad to set Parameter.
	Parameter locked	Check the lock parameter (P000).
	SW1 in left position	Switch SW1 (underneath display) to the right.
Display remains blank	Improper power source wiring	Check wiring of power source.
	Supply voltage is incorrect	Ensure proper supply voltage is applied.
	Power selection switch is in wrong position	Ensure power selection switch is in the correct position.
	Faulty Fuse	Check to see if fuse is installed, or in good condition.
	Cables are not connected properly	Check cables between display and motherboard.
Display shows **BF**	Battery Failure	Check to see if battery needs to be installed, or replaced
Keypad is not operative	Improper Cabling	Ensure cable connecting keypad to motherboard is intact.
	SW1 in left position	Switch SW1 (underneath display) to the right.
	Incorrect security settings	Check security code P000 and security level P350.
LVDT Conditioning Card doesn't function	Devices are not interconnected properly	Check interconnecting wiring between LVDT and conditioning card and conditioning card and the SF 500.
	Devices are not interconnected properly	Check to ensure that SF 500 terminals 2 and 17 are interconnected.
Rate display seems to be chaotic	Improper wiring	Check wiring from LVDT, or load cells).
	Millivoltage levels are incorrectly set	Measure millivoltage levels across SF 500 terminals 1 & 2 and compare to P940 01 (Load Cell A) and, if applicable, across SF 500 terminals 3 & 4 and compare to P940-02 (Load Cell B). If there are major differences in readings, contact Siemens Milltronics.
Memory Test P901 fails	Memory is bad	Contact Siemens Milltronics.
Error message flashing on display	Error that occurred some time ago, may remain on display, flashing	Verify if error is still active. Cycle SF 500 from **PROGRAM** to **RUN** modes.

Symptom	Cause	Action
Can't print	Not all needed parameters have been programmed	Ensure all needed parameters have been programmed.
	Improper wiring between printer and SF 500	Ensure proper wiring is done.
	The SF 500 is not in **RUN** mode.	To print, switch to **RUN** mode.
Changed a communications Parameter but does not seem to be working	The SF 500 power must be cycled prior to any communications parameter taking effect	Cycle The SF 500 power.
Can't communicate using Port #2 with 7 data bits	The communications port #2 is limited to 8 data bits	Use another communications port if 7 data bits are required.
Remote Totalizer 1 or 2 Exceeded error message	Remote totalizer buffer has overflowed	The remote totalizer resolution has to be increased.
	Remote totalizer buffer needs to be cleared	The Internal Totalizer Reset, P648, must be cleared
Poor communications using Modbus RTU and ASCII	Improper wiring or shielding	Ensure proper wiring and shielding.
	Improper Baud Rate	Try different Baud Rate.
	Improper request length	Decrease request length.

General-Communications

1. First check to see that:
   - There is power at the unit
   - The LCD is showing something
   - The device can be programmed using the fixed keypad.

1. Then, check the wiring pin outs and verify that the connection is correct.

2. Next, go over the setup parameter P770 to P779 and verify that these values match the settings in the computer that you are using to communicate with it.

3. Finally, if you should check that the port you are using on the computer. 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. This driver is very useful to test communications.

Error Codes

Error Code	Code Name	Message/Action
201	Error - Load Cell A & B	Reading between A & B > 20000, or no signal. Check wiring.
203	Err: 203	Memory failure test. Consult Siemens Milltronics.
204	Integrator not configured	P002-P017 must be programmed.
205	Err: 205	Zero or span calibration required.
210	Remote Totalizer 1 exceeded	Increase resolution.
211	Remote Totalizer 2 exceeded	Increase resolution.
213	Maximum rate exceeded	Rate is > thee times the design rate. If no mechanical cause, check to see if re-rating the design rate is required.
220	Span too low	Span is < 1 mV. Insure proper test weight or chain is applied during span.
221	Span out of range	Span deviation > 12.5%. Consider an initial zero (P377). Refer to *Initial Zero* on page 34.
222	Zero out of range	Zero deviation > minimum limit. Consider an initial Span (P388). Refer to *Initial Span* on page 37.
223	Security Violation	An attempt to run command / calibration that is not allowed under current security level.
224	Function not permitted	Function not allowed under current security level.
225	BF	Flashes in the bottom right corner of display when battery charge is too low.
226	Load Cell AD's are not functioning	Consult Siemens Milltronics.
227	Err: 227	No process data available. Consult Siemens Milltronics.
228	Batch pre-act adjustment > 10%	Pre-act adjustment is ignored. Tune process to limit batch error.
240	Integrator not configured	P002-P017 must be programmed
241	No PID mA Input	PID Process Value Source (P402) or PID Setpoint (P414) has been programmed for a mA Input, however mA Input Function (P255) has not been programmed properly.
242	No PID mA Output	PID System (P400) has been turned on, but mA Output (P201) has not been programmed properly.
243	No batch setpoint relay	Batch has been set up, but no relay has been configured for a setpoint.
PF	Power Failure	Displayed at the bottom right corner of the display if power is interrupted after the integrator has been calibrated.

Glossary

Auto Zero
Allows a zero calibration to be performed automatically in **RUN** mode when the rate drops below 2% of design for 1 complete calibration period (P360).

A.uxiliary Inputs
Can be programmed to allow the use of an external contact to provide the following functions, display scroll, totalizer 1 reset, Zero, Span, Multispan, Print, Batch reset, or PID functions.

Batching
The accumulation of a predetermined quantity of material.

Contacts
A junction of electrical conductors in open (not connected) or closed (connected) states.

Damping
Provides control over the speed at which the displayed rate readings and output functions are updated in response to changes in the internal rate signals.

Design Rate
This is the maximum material flow rate for this particular application (100% full scale).

Direct Span
If replacing software or hardware, this allows the entry of the previously recorded span value.

Direct Zero
If replacing software or hardware, this allows the entry of the previously recorded zero value.

Factoring
Used to calculate the test rate value of a new or unknown test weight using the current span as reference.

Input/Output Trim
Allows the 4 and 20 mA values to be adjusted and verified with an external source (meter).

Initial Span
Usually the first span performed, it is used as reference for all other spans to determine whether they have deviated beyond the accumulated +/- 12.5%.

Initial Zero
Usually the first zero performed, it is used as reference for all other zeros to determine whether they have deviated beyond the Zero Limit (P370).

Linearization
Compensates for non-linear output of the flowmeter caused by varying load rates.

Load Cell
Strain Gauge type transducer that produces an electrical output proportional to force (load) applied.

LVDT
An electromechanical transducer that produces an electrical output proportional to the displacement of a separate movable core.

mA
A unit of measure for current flow, milliamperes.

Material Test
Material samples used to verify the accuracy of the span calibration.

Modbus
An industry standard protocol used by popular SCADA and HMI systems.

Multispan
Since every material has its own unique physical properties, and may impact differently, a span calibration is required for each material to realize maximum accuracy.

PID
Proportional Integral Derivative control is used to control the feed rate to a setpoint, either internal to the SF 500 or external.

RAM
Random Access Memory.

Random Access Memory
Memory that has both read and write capabilities.

Relay
An electromechanical device with contacts that can be closed or opened by energizing a coil.

Routine Span
Any operator initiated span calibration.

Routine Zero
Any operator initiated zero calibration.

Setpoint
A value that the integrator is trying to match.

SmartLinx®
An interface to popular industrial communication systems.

SPA
Single Parameter Access, used to view or edit parameters through the available communication ports.

Span
This is a count value representing the mV signal provided by either the LVDT or Load Cell at 100% design load.

Span Register
This is the number of span calibrations that have been performed since the last master reset.

Test Weight
A calibrated weight which will represent a certain load on the scale.

Totalizer
An incremental counter that records the total of material that has been monitored.

Zero Register
Shows the number of zero calibrations that have been performed since the last master reset.

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