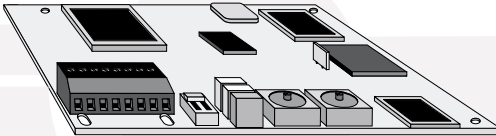


# SMARTLINX INTERFACE MODULE FOR PROFIBUS-DP

Instruction Manual PL-534

April 2001



## 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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While we have verified the contents of this manual for agreement with the instrumentation described, variations remain possible. Thus we cannot guarantee full agreement. The contents of this manual are regularly reviewed and corrections are included in subsequent editions. We welcome all suggestions for improvement.

Technical data subject to change.

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# Specifications

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**Application:**

- compatible with a master device on a Profibus bus

**Compatible Instruments:**

- AiRanger XPL Plus
- AiRanger DPL Plus
- AiRanger SPL
- CraneRanger
- InterRanger DPS 300
- EnviroRanger ERS 500
- Accumass BW500

**Communication Settings:**

- baud rate: 9.6 Kbaud to 12 Mbaud, automatically detected

**Connection:**

- varies by Milltronics SmartLinx<sup>®</sup> instrument, (see page 12)

**Termination:**

- switch selectable, open or special active termination as per Profibus specification (see Termination Switch on page 11).

**Cable:**

- Belden Profibus cable 3079A, or equivalent



# About SmartLinx<sup>®</sup> Profibus DP...

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## About this Manual...

This manual provides you with the information required to successfully install and connect a Milltronics SmartLinx<sup>®</sup> Profibus-DP module and set it up for communication with a master device on a Profibus-DP network.

This manual is targeted at a technical audience in the industrial communications field with a sound working knowledge of Profibus-DP.

Profibus is an open standard controlled by Profibus industry groups worldwide. More information is available on the web site at [www.profibus.com](http://www.profibus.com).

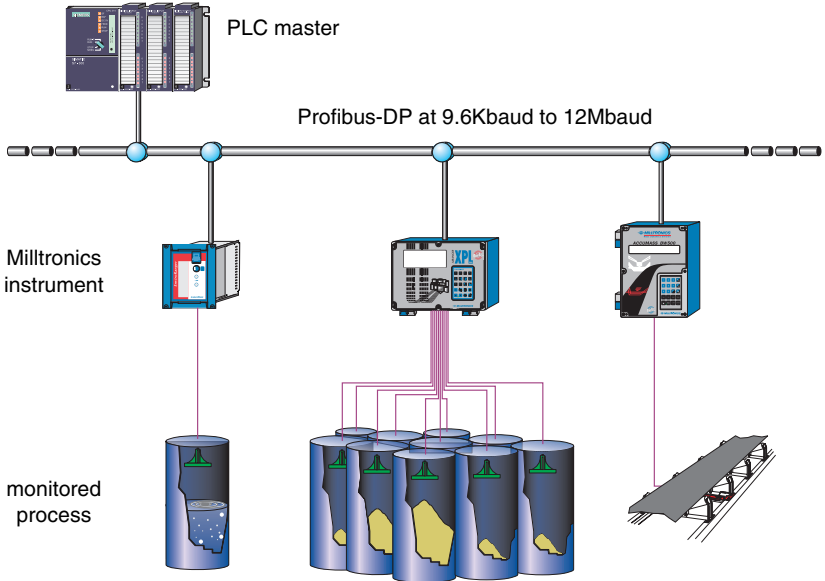
**Note:**

Milltronics does not own the Profibus-DP protocol. All information regarding that protocol is subject to change without notice.

# About this Module...

The Milltronics SmartLinx Profibus-DP module is a plug-in communications card designed to interface a Milltronics SmartLinx-compatible instrument to a Profibus-DP network.

Only those instruments which support the Profibus-DP protocol can use this card. See Compatibility on page 9 for a list of compatible Milltronics SmartLinx instruments.



About this ...



# Installation

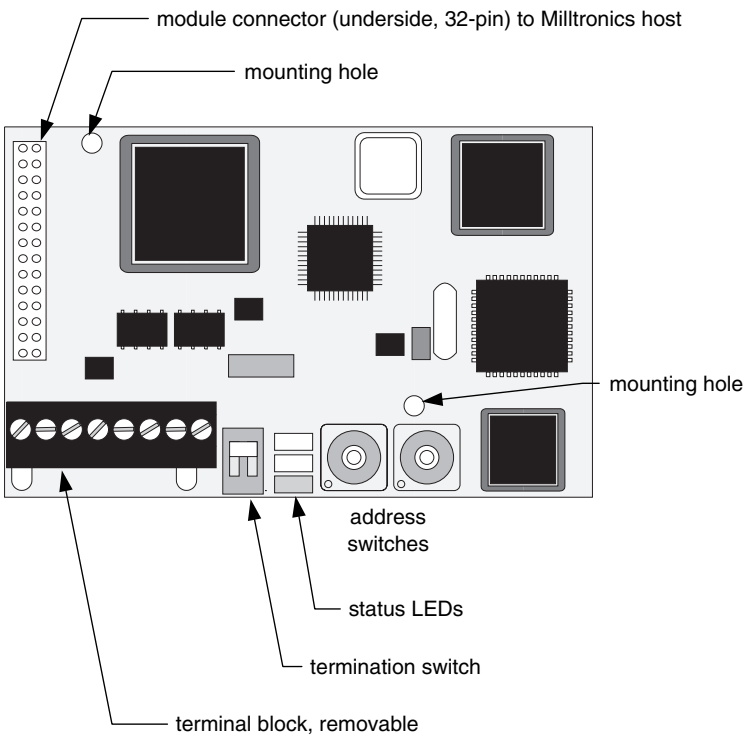
The SmartLinX module is either shipped installed in the Milltronics instrument or separately for on-site installation. Refer to the manual of your Milltronics instrument for details on module location and physical installation.

## Compatibility

All available SmartLinX card configurations are shown here for reference.

**The card shown below is compatible with the following Milltronics units:**

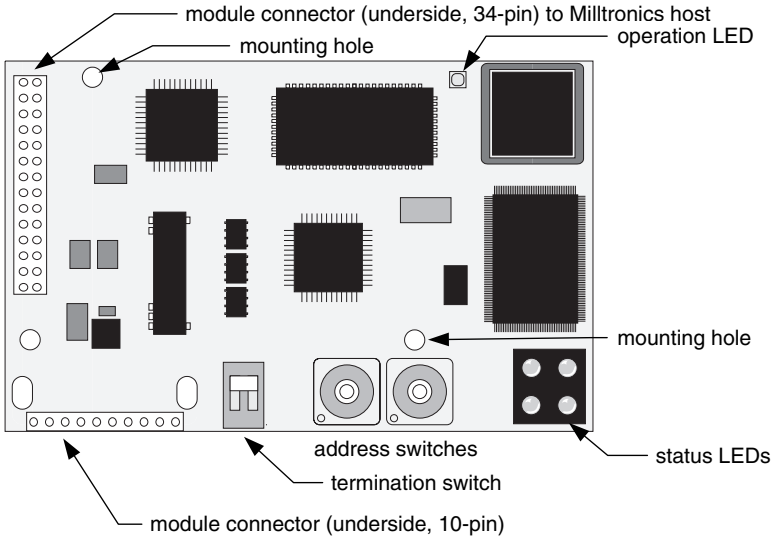
- AiRanger XPL Plus
- AiRanger DPL Plus
- AiRanger SPL
- CraneRanger
- InterRanger DPS 300



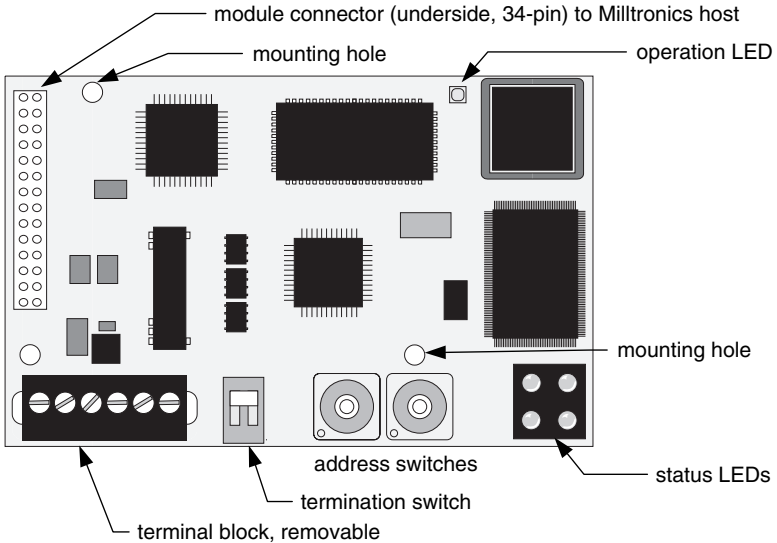
The cards shown below are compatible with the following Milltronics units:

- EnviroRanger ERS 500
- Accumass BW500

**EnviroRanger Rack or Panel**



**EnviroRanger Wallmount and Accumass BW 500**

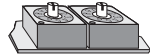


**Note:**

Correct cable routing is important for electromagnetic noise suppression. Follow the routing instructions contained in the Accumass BW500 manual.

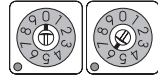
# Address

Set the two rotary switches to the address for this slave.



Use a slave address switch in the range 03 to 99.

This example shows the value "06".



# Baud Rate

The module configures itself to the correct baud rate for the Profibus-DP network.

# Termination Switch

Termination	Setting	Switch Position
open (not used)	off	
<p>+5V ——— 390Ω ——— Line A ——— 220Ω ——— Line B ——— 390Ω ——— -5V</p>	on	

Profibus DP requires termination of the bus at both end points, see the Profibus DP specifications for details.

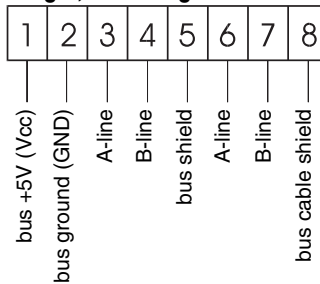
# Cable Connector

Connect using Belden Profibus cable 3079A or equivalent and terminate according to Profibus-DP specification and conventions.

## Notes:

- Use only A-line and B-line for most applications.
- The +5V bus (Vcc) and Ground (GND) terminals are used to pull-up or pull-down the bus voltage, use only if required. See the RS-485 specifications for details.
- Request to Send (RTS) is used in some equipment to determine the direction of transmission, use only if required.

## AiRanger Series, CraneRanger, InterRanger DPS 300



## Note:

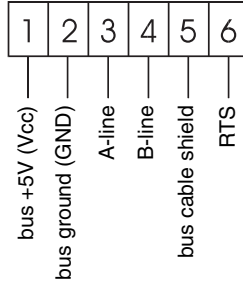
To daisy-chain devices, connect the outgoing wires to terminals 6 and 7.

## EnviroRanger ERS 500 (Rack or Panel mount)

When using a SmartLinX card with the EnviroRanger (rack or panel mount) all wiring is made to the EnviroRanger terminal board. The Profibus connections map to the EnviroRanger terminal board as shown:

EnviroRanger	Connection
65	Gnd_bus
66	RTS
68	A
69	B
71	V_bus +5V
67	bus cable shield

## EnviroRanger ERS 500 (Wallmount) and Accumass BW 500



### Note:

To daisy-chain devices with the BW500, connect both wires to the existing A-line and B-line terminals.

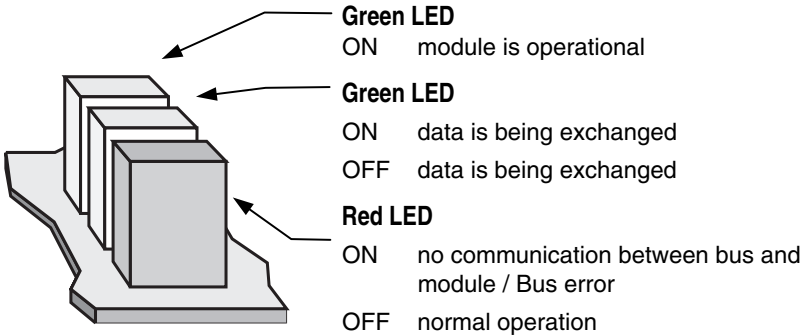


# Operation

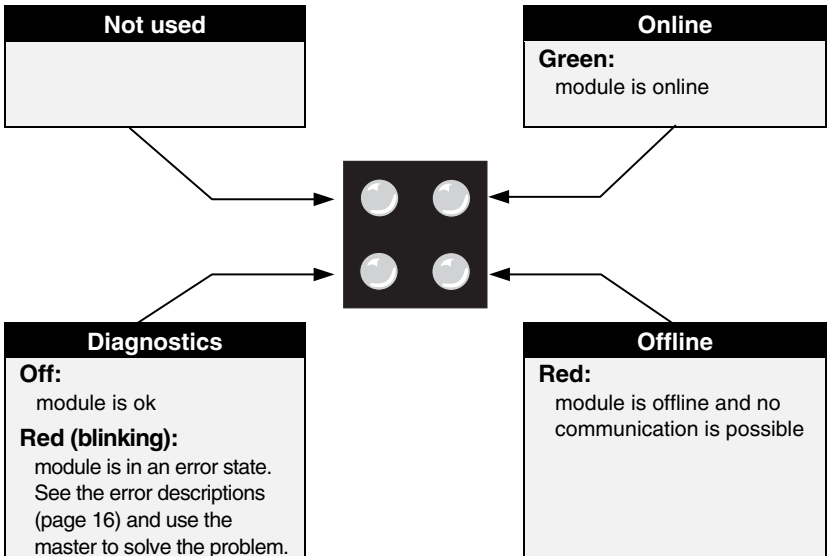
Communication on the Profibus-DP link is indicated by the SmartLinX LED's.

## Error Status LED's

**AiRanger Series, CraneRanger, InterRanger DPS 300**



**EnviroRanger ERS 500 and Accumass BW500**



# Error Conditions

## 1Hz – Error in Configuration

Indicates that the I/O length variable set during initialization is not equal to the length set during configuration of the network. See Configuring the Master on page 17 for lengths supported by the SmartLinX module and see your PLC documentation for setting the I/O length variable.

## 2Hz – Error in User Parameter Data

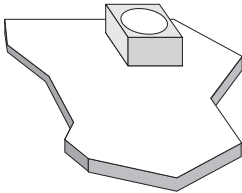
Indicates that the length and / or contents of the user parameter data set during initialization of the module is not equal to the length and / or contents set during configuration of the network. See Configuring the Master on page 17 for supported lengths.

## 4Hz – Error in Initialization

Consult your Milltronics representative.

# Operation LED

## EnviroRanger ERS 500 and Accumass BW500 only



### LED

- blinks orange as the module is initialized
- blinks green during normal operation



# Communication Setup

---

The SmartLinX Profibus-DP module is a slave on the bus, and does not use any Milltronics instrument parameters for configuration. Set the rotary switches on the module to the desired slave address, other settings are provided in the GSD file or are automatically detected.

## GSD Files

Profibus master devices require a configuration file for each slave device on the network. This file configures the master for the capabilities and limitations of the slave. For the SmartLinX Profibus-DP module these files are:

- AiRanger Series: HMS-1002.GSD
- BW500 or ERS 500: HMS1003.GSD

Both files are supplied on the floppy disk that is shipped with the module.

The file HMS-1002.GSD uses the manufacturer's I.D. number of 1002 hexadecimal (4,098 decimal). The file HMS1003.GSD uses the manufacturer's I.D. number 1003 hexadecimal (4,099 decimal).

## Configuring the Master

Use the configuration software (or any equivalent master commands) to configure the slave. Refer to the information that came with the Profibus master. The Milltronics instrument appears as a modular type slave, and should be configured as shown below:

### **Warning:**

**The size of the read and write blocks should exactly match the values given below or a bus fault may occur on some systems.**

### **Level Products (includes AiRanger Series and ERS 500)**

- 84 bytes input (see Write Block on page 24).
- 26 bytes output (see Read on page 27).
- read and write data as 16-bit words (see Data Types on page 39).

### **Mass Dynamics Products (includes BW500)**

- 62 bytes input (see Write on page 30)
- 38 bytes output (see Read on page 34)
- read and write data as 16-bit words (see Data Types on page 39)

If your Profibus master is not capable of handling the block sizes listed above then use multiple, smaller blocks.

**For example**

An S5-115U with an IM 308C master would use the following:

**For Level products:**

**Inputs:** 3 address blocks of 16, 16, and 10 words

**Outputs:** 1 address block of 13 words

**For Mass Dynamics products:**

**Inputs:** 2 address blocks of 16 and 15 words

**Outputs:** 2 address blocks of 16 and 3 words

**Notes:**

- Data is read and written with the most significant byte (MSB) first.
- The address and size of the reads and writes in the PLC must match the Milltronics device (see above).
- Profibus-DP diagnostic bytes are not supported, however, some diagnostic information can be accessed via reading and writing the data areas. See Application Layer on page 19.

## Baud Rate

The SmartLinx Profibus module automatically configures itself to the baud rate used on the bus.

Follow the Profibus guidelines with regards to bus length and baud rate.

This section describes the meaning of data read from and written to the Milltronics SmartLinX instrument slave memory. The output words (PLC master write operation) and input words (PLC master read operation) are described in the Data Map for Level Products on page 24 and the Data Map for Mass Dynamic Products on page 30.

**Note:**

Parameter P999 (Master Reset) is not accessible via the SmartLinX interface on Level products.

## Parameter Indexes

Most parameters used on Milltronics SmartLinX instruments are indexed. Indexing allows a parameter to relate to more than one input or output. For example, many parameters are indexed by measurement point while others are indexed by relay output or discrete input.

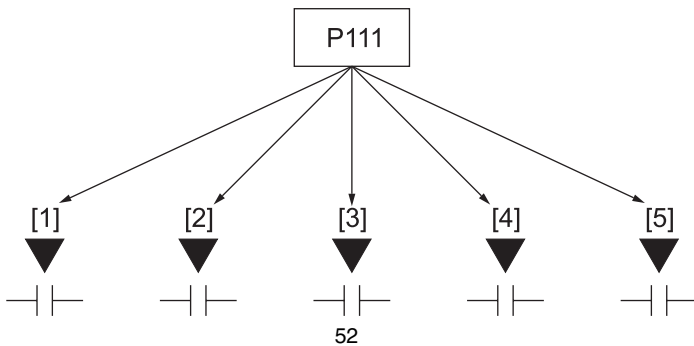
### Primary Index

An index that relates to an input or output is called a Primary Index.

**Examples of primary indexes are:**

P111[3] = 52 means:

P111 (Relay Control Function) for relay 3 is set to value 52



Sometimes a parameter requires a second index to allow for multiple values on an indexed input or output. For example a measurement point which calculates a reading on volume can require characterization breakpoints. These breakpoints are given on a secondary index (the primary index relates to the transducer input).

On some older Milltronics products the primary index is called a point.

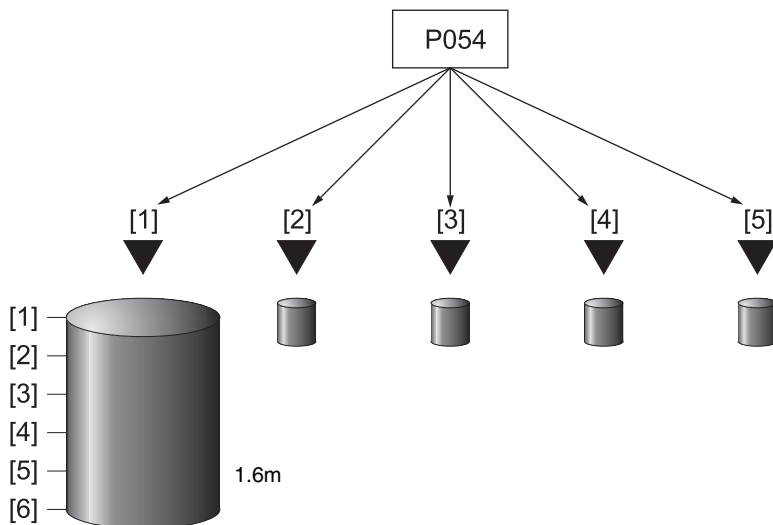
## Secondary Index

An index that relates to a previously indexed parameter is called a secondary index.

### Examples of secondary indexes are:

P054[1,5] = 1.6m means:

P054 (Breakpoint Levels) for breakpoint 5 on transducer 1 is set to 1.6m



The way that indexes are handled in the memory map depend on the data access method used.

On some older Milltronics products the secondary index is called a mark.

## Data Access Methods

There are three different methods used in the memory mapping to give access to the SmartLinx Instrument parameter table. They are:

- Direct Access
- Multiple Parameter Access (MPA)
- Single Parameter Access (SPA)

### Direct Access

Certain values are mapped directly into words. These words can be monitored continuously but they are not configurable.

## Multiple Parameter Access (MPA)

**Note:**

MPA is used on Level products only.

This is a hand-shaking method where the user specifies the parameter number, secondary index, decimal place, and format, then the SmartLinx will write into a certain area all 10 primary indexes of that parameter.

**Note:**

Recall that in Milltronics' products, the memory is arranged as Parameter number, Primary Index, Secondary Index.

### Using Multiple Parameter Access (MPA)

1. In the output table of the PLC (Write Block) write the values for the parameter number, secondary Index, decimal place and format in the correct location.
2. Monitor the Input table of the PLC (Read Block), and watch for the values you wrote to appear in the appropriate locations of the read block, then go to Step 3.
3. Read the requested values in the appropriate location of the Read Block. These values are continuously updated. Continue reading from these words until values for another parameter are required. At that time, go to step 1.

**Note:**

MPA values are only updated in Run mode (word 12 = 0).

### Parameter Indexing with MPA

**Primary Index**

The primary index is implicit in the memory address. MPA values are returned through words 21 to 30 of the read block (see page 27).

**Secondary Index**

The secondary index is nearly always left at zero. See the manual for the Milltronics SmartLinx instrument for information on parameters, including which require a secondary index.

## Single Parameter Access (SPA)

**Note:**

SPA is used on both Level and Mass Dynamics products.

This is a hand-shaking method where the PLC specifies:

- parameter number
- primary index
- secondary index
- decimal place
- format
- read/write flag
- value

With this method any value in the Milltronics product can be read or written.

### Using Single Parameter Access (SPA)

SPA allows continuous monitoring or demand programming of a parameter.

#### Reading a Parameter

1. Set the Read/Write flag in the output table (Write Block) to 0, “read”.
2. Write the Parameter Number, Primary Index, Secondary Index, Decimal Place and Format in the correct locations.

**Note**

If there is no secondary index, then place a 0 in this location.

3. Monitor the Input table of the PLC (Read Block) and watch for the values you wrote to appear in the appropriate locations, then go to Step 4.
4. Read the requested parameter value in the Input table (Read Block). These values are continuously updated. Continue reading from these words until values for other parameters are required. At that time, go back to step 1.

#### Writing a Parameter

1. Set the Read/Write flag in the output table (Write Block) to 0, “read”.
2. Write the Parameter Number, Primary Index, Secondary Index, Decimal Place and Format in the correct locations.
3. Write the new value of the parameter into the correct location of the output memory (Write Block)
4. Verify the unit is in program mode (not needed for BW500). For Level see bit 10 of status word in Read Block.

5. If it is not in program mode, write a 1 to the operating mode word in the output memory (Write Block). Please note that this will only work if the word is already a 0 (ie. it only works as a transition).
6. Set the Read / Write flag in the output table (Write Block) to a 1 "write".
7. Monitor the Input table of the PLC (read block) and watch for the values you wrote to appear in the appropriate locations.
8. Set Read / Write flag back to 0.
9. Place unit in Run mode.

**Note (does not apply to Accumass BW 500):**

Parameters can only be written in Program mode (word 12 = 1). If the host instrument is still in Run mode then any written values are ignored.

# Data Map

## Level Products

This section describes the meaning of the data read from and written to the Milltronics SmartLinX instrument.

Refer to the PLC documentation on how to program reads and writes in your PLC.

## Write Block

Word	Description	Access	Data Type
0	measurement point on priority	direct	bitmapped
1	parameter number	MPA	integer
2	parameter secondary index (mark)		integer
3	decimal place		integer
4	format		0/1
5	parameter number		SPA
6	parameter primary index (point)	integer	
7	parameter secondary index (mark)	integer	
8	parameter value	integer	
9	decimal place	integer	
10	format	0/1	
11	read/write flag	0/1	
12	operating mode	direct	0/1

## Word 0: Point-on-Priority

Bits 00-09 set the priority status of corresponding indexed points 1 to 10.

bit	09	08	07	06	05	04	03	02	01	00
index	10	9	8	7	6	5	4	3	2	1

bit status    0 = normal  
                   1 = priority

In the example...

bit	09	08	07	06	05	04	03	02	01	00
index	0	0	0	0	0	0	0	1	0	1

...points 3 and 1 are on priority scan. All other bits are reserved and contain 0.



If this word is used to control point-on-priority, then the Milltronics SmartLinx instrument must be configured to permit this. Parameter P720 must be set to 1 (manual, BIC-II or SmartLinx SPA) for each point to permit priority control for that point.

To enable priority control for all indexed measurement points use SPA to store "1" to parameter P720, index 0 (P720[0]).

## Word 1: Parameter Number, MPA

Specifies the parameter number for the returned values in words 21 to 30. See Read on page 27.

## Word 2: Parameter Secondary Index, MPA

Specifies the secondary index for the parameter specified by word 1. This word is ignored for parameters that don't use multiple indexes. See Parameter Indexes on page 19 for more information.

### Note:

The Primary Index is implicit in the word location where word 21 = index 1 and word 30 = index 10.

## Word 3: Decimal Place, MPA

Specifies the number of decimal places to shift the returned values. This affects words 21 to 30.

Positive values indicate that the decimal place shifts to the left.

i.e. A "1" means that all returned values have the decimal place shifted 1 space to the left and a returned value of 5,213 is interpreted as 521.3.

Negative values indicate that the decimal place shifts to the right.

i.e. If this word is "-1", a returned value of 5,213 is interpreted as 52,130.

## Word 4: Format, MPA

Sets the format for the returned values in words 21 to 30.

0 = normal

1 = percent

## Word 5: Parameter, SPA

Specifies the requested parameter number.

## Word 6: Primary Index, SPA

Specifies the primary index number for the parameter in word 5.

## Word 7: Secondary Index, SPA

Specifies the secondary index for the parameter in word 5. This word is ignored for parameters that don't use multiple indexes. See Parameter Indexes on page 19 for more information.

## Word 8: Value, SPA

This word contains the value written to the specified parameter and index. The format of this word is specified by words 9 to 10.

To write a value, ensure word 11 = 1 and word 12 = 1. See also: Data Types on page 39.

## Word 9: Decimal Place, SPA

This word specifies the number of decimal places for the value in word 8, and also for the parameter value returned in word 38.

Positive values indicate that the decimal place shifts to the left.

i.e. A 1 means that all returned values have the decimal place shifted 1 space to the left and a returned value of 5,213 is interpreted as 521.3.

Negative values indicate that the decimal place shifts to the right.

i.e. If this word is "-1", a returned value of 5,213 is interpreted as 52,130.

## Word 10: Format, SPA

This word sets the format for the value in word 8.

0 = normal

1 = percent

## Word 11: Read/Write Flag, SPA

This word instructs the read/write application of word 8.

0 = read parameter as described by words 5, 6, 7, 9 and 10; word 8 ignored

1 = set parameter to the value described by words 5 to 10

## Word 12: Operating Mode, SPA

This word sets the operating mode of the Milltronics SmartLinX instrument.

The operating mode can get out of sync if the remote instrument resets back to run mode locally. This can happen due to a timeout or through local programming. The mode is always reported correctly through the Read block. See bit 10 of Word 0: Instrument Status on page 27.

To reset the instrument to program mode you must write “0” to put the SmartLinX module back in sync with the instrument and then write “1” to set the instrument to program mode.

0 = run mode

1 = program mode

## Read Block

Values in words 0 to 20 are directly available, no write operation is required to request them.

Values in words 21 to 41 are determined by the write operation that requested them, either MPA or SPA. See Write Block on page 24.

Words	Description	Access	Data Type
0	instrument status	direct	bitmapped
1-10	point reading		integer
11-20	point alarm and status		bitmapped
21-30	returned values	MPA	integer
31	decimal place		integer
32	format		0/1
33	parameter number		integer
34	parameter secondary index		integer
35	parameter	SPA	integer
36	parameter primary index		integer
37	parameter secondary index		integer
38	value		integer
39	decimal place		integer
40	format		0/1
41	read/write flag		0/1

## Word 0: Instrument Status

**bit**                      **description**

00 to 09:                measurement point status  
indicates the operation of measurement points 1 to 10.

bit	09	08	07	06	05	04	03	02	01	00
index	10	9	8	7	6	5	4	3	2	1

0    operational

1    non-operational

These bits consolidate the values from words 11 to 20, bits 00 to 03. If any of those bits are “1” (point non-operational) then the word 0 bit for that point is also “1”.

- 10:        operating mode  
           0 = Milltronics SmartLinx instrument in “run” mode  
           1 = Milltronics SmartLinx instrument in “program” mode
- 11 to 15: reserved  
 These bits are reserved and set to 0.

## Words 1 to 10: Point Reading

These words contain the value of parameter P920 (Reading) for points 1 to 10, respectively. The reading is expressed as a percent of full scale, multiplied by 100, giving a range of –20,000 to 20,000 which corresponds to -200.00% to 200.00%. Refer to the Milltronics SmartLinx instrument documentation for a definition of “P920”.

### Note

These values may contain numeric level data for inoperative or malfunctioning points – refer to read word 0, and read words 11 to 20 for the actual operational status of the measurement points.

## Words 11 to 20: Point Alarm and Status

These words contain the corresponding alarm and status bits for indexed measurement points 1 to 10, respectively.

### Bit status:

- 0 = false  
 1 = true

Bit	description
00	point not in service
01	point failsafe timer expired
02	point failed (cable shorted, open, or transceiver problem)
03	point temperature sensor failed
04 to 12	reserved for future use
13	level emptying
14	level filling
15	scan mode priority

## Words 21 to 30: Returned Values, MPA

These words contain values requested by writing to words 1 to 4. The type of data and format are specified with that request, and returned in block transfer read words 31 to 34.

## Word 31: Decimal Place, MPA

This word specifies the number of decimal places in each of the returned values in words 21 to 30.

Positive values indicate that the decimal place shifts to the left.

i.e. A 1 means that all returned values have the decimal place shifted 1 space to the left and a returned value of 5,213 is interpreted as 521.3.

Negative values indicate that the decimal place shifts to the right.

i.e. If this word is “-1”, a returned value of 5,213 is interpreted as 52,130.

## Word 32: Format, MPA

This word sets the format for the returned values.

bit status	description
0	normal
1	percent

### Note:

When the format is selected as “percent” the decimal place value (word 3 of the write block) is ignored and two decimal places are always used. For example, a value of 5947 represents 59.47%.

## Words 33 and 34: Parameter Number and Secondary Index, MPA

These words contain the last values written to write block words 1 and 2, respectively. These words indicate what information is contained in read block words 21 to 30. These words are provided since there can be a delay between writing a request, and the appearance of the requested values.

Use these words as an indicator that the requested information is updated.

## Words 35 to 37 and 39 to 41: Parameter Number / Primary Index / Secondary Index and Decimal Place / Format / Read Write Flag, SPA

These words contain the last values written to words 5 to 7 and 9 to 11 of the write block. They confirm that the parameter value has been written. These words are not updated until the value has been successfully transferred and stored in the Milltronics SmartLinX instrument.

See write formats on page 25 for details.

## Word 38: Value, SPA

This word contains the current value of the parameter identified by words 35 to 37 and 39 to 40, regardless of the value of word 11 (write flag).

If this value does not change when a new value is written to word 8 (Parameter Value) then check the following:

1. If words 5 to 7 and 9 to 10 **do not** match read 35 to 37 and 39 to 40 then the instrument hasn't responded yet.
2. If words 5 to 7 and 9 to 10 **do** match read 35 to 37 and 39 to 40 then the parameter value wasn't updated. Check that the Milltronics SmartLinx instrument is in program mode and that the program lock (P000) is not on and try again.

## Data Map

### Mass Dynamics Products

#### Write Block

The words in the write operation allow access to the Milltronics SmartLinx instruments as Single Parameter Access (SPA) only.

Description	Start	End	Size	Data Type
parameter number, SPA	0	0	1	integer
primary index, SPA	1	1	1	integer
secondary index, SPA	2	2	1	integer
value, SPA	3	4	2	UINT32
decimal place, SPA	5	5	1	integer
format, SPA	6	6	1	integer
read/write flag, SPA	7	7	1	integer
command control	8	8	1	bitmapped
multispan selection	9	9	1	1-4
PID 1 setpoint value	10	11	2	UINT32
PID 2 setpoint value	12	13	2	UINT32
batch setpoint value	14	15	2	UINT32
batch prewarn setpoint value	16	17	2	UINT32
word order	18	18	1	0/1

#### Notes:

- All the 32 bit numbers (except for the SPA numbers) have a fixed decimal place of 3 digits. For example PID 1 setpoint value of 3,245 is a value of 3.245 in the BW500.
- To make a change to any parameter in the BW500 using SmartLinx, P799 Communications Control must be set to 1.

#### Word 0: Parameter, SPA

Specifies the parameter number.

## Word 1: Primary Index, SPA

Specifies the primary index number for the parameter specified by word 0.

## Word 2: Secondary Index, SPA

Specifies the secondary index for the parameter specified by word 0. This word is ignored for parameters that don't use multiple indexes.

## Words 3, 4: Value, SPA

The new value of the specified parameter and index.

## Word 5: Decimal Place, SPA

This word specifies the number of decimal places for the value in words 3 and 4.

Positive values indicate that the decimal place shifts to the left.

i.e. A 1 means that all returned values have the decimal place shifted 1 space to the left and a returned value of 5,213 is interpreted as 521.3.

Negative values indicate that the decimal place shifts to the right.

i.e. If this word is "-1", a returned value of 5,213 is interpreted as 52,130.

## Word 6: Format, SPA

This word is always 0.

## Word 7: Read / Write Flag, SPA

This word determines whether the instrument will allow parameter values to be written.

0 = read

1 = write

## Word 8: Command Control, Operational Commands

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 to 12) must change state in order to cause the command to 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 (0)	Bit Set (1)
00	PID 1 mode	manual	auto
01	PID 1 freeze	no	yes
02	PID 1 setpoint source	local	remote
03	PID 2 mode	manual	auto
04	PID 2 freeze	no	yes
05	PID 2 setpoint source	local	remote
06	zero	no change	start
07	span	no change	start
08	reset totalizer 1	no change	reset
09	reset totalizer 2	no change	reset
10	reset batch totalizer	no change	reset
11	print		print
12		reserved	
13		reserved	
14		reserved	
15		reserved	

### Bit 00 and 03: PID Mode

Sets the mode of PID control to either manual (output determined by P410 – PID Manual) or auto (output determined by PID control in instrument).

### Bit 02 and 05 Setpoint Source

Controls the location of the setpoint. If it is set as “local”, then the setpoint used is internal to the BW500. If the setpoint source is set to “remote”, then the setpoint is controlled by a mA input.

For setpoint control through communications this must be set to “local.”

### Bit 01 and 04: Freeze

Suspends PID function when PID Mode = 1 (“auto”) and holds the output at the last value. PID functionality resumes when the freeze bit is cleared.

### Bit 06: Zero

Sets the zero point for calibration of the belt scale.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted read word 0, bit 7 (zero status) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.

### Bit 07: Span

Sets the span for calibration of the belt scale.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted read word 0, bit 8 (Span Status) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.



**Bit 08: Reset Totalizer 1**

Causes the internal totalizer 1 to be reset to 0.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted, read word 0, bit 9 (Reset Totalizer 1) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.

**Bit 09: Reset Totalizer 2**

Causes the internal totalizer 2 to be reset to 0.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted read word 0, bit 10 (Reset Totalizer 2) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.

**Bit 10: Reset Batch Totalizer**

Causes the batch totalizer to be reset to 0.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted read word 0, bit 11 (Reset Batch Totalizer) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.

**Bit 11: Print**

Starts print operation. One of the communications ports on the BW500 must be configured for a printer.

This is a momentary setting that must be reset to “0” once the input is accepted. To check that the input was accepted read word 0, bit 12 (Printing) and ensure it shows a “1”. Once it shows a “1” then reset this bit to “0”.

**Word 9: Multispan Selection**

Sets the current span (1 to 4). Any parameters that relate to span will use this value to determine which span is referenced. See the manual for the BW500 for more information on multispan.

**Words 10 to 13: PID Setpoints**

Contain the current setpoint values as P415 in the Accumass BW500.

To write these setpoints bits 02 and 05 in word 8 - Control must be set to “local.”

**Words 14 and 15: Batch Setpoint**

Contain the current setpoint value as P564 in the Accumass BW500.

**Words 16 and 17: Batch Prewarn Setpoint**

Contain the current setpoint value as P567 in the Accumass BW500.

## Word 18: Word Order

This word controls which word comes first in the UINT32 integers. For a value 0, the most significant word is given first. For a value 1, the least significant word is given first.

- 0 MSW first
- 1 LSW first

## Read Block

Values returned in the words in the read are in response to the write to the Milltronics SmartLinX instrument.

Words 0 through 20 have values with fixed meanings and formats. This means that you do not have to start communications with a write in order to use read, the data is always there.

Words 22 through 30 are values returned in response to writing words 2 through 7 for Single Parameter Access (SPA).

Description	Start	End	Size	Type
instrument status	0	0	1	bitmapped
rate	1	2	2	UINT32
load	3	4	2	UINT32
speed	5	6	2	UINT32
total 1	7	8	2	UINT32
total 2	9	10	2	UINT32
relay status	11	11	1	bitmapped
discrete input status	12	12	1	bitmapped
multispan selection	13	13	1	integer
PID 1 setpoint value	14	15	2	UINT32
PID 2 setpoint value	16	17	2	UINT32
batch setpoint value	18	19	2	UINT32
batch prewarm setpoint value	20	21	2	UINT32
parameter, SPA	22	22	1	integer
primary index, SPA	23	23	1	integer
secondary index, SPA	24	24	1	integer
value, SPA	25	26	2	UINT32
decimal place, SPA	27	27	1	integer
format, SPA	28	28	1	integer
read / write flag, SPA	29	29	1	1/0
word order	30	30	1	1/0

## Word 0: Instrument Status

This word is used to feed back 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 Milltronics SmartLinx instrument commands.

Bit #	Description	Bit Clear (0)	Bit Set (1)
0	PID 1 mode	manual	auto
1	PID 1 freeze	no	yes
2	PID 1 setpoint source	local	remote
3	PID 2 mode	manual	auto
4	PID 2 freeze	no	yes
5	PID 2 setpoint source	local	remote
6	zero	no	in progress
7	span	no	in progress
8	reset totalizer 1	no change	reset
9	reset totalizer 2	no change	reset
10	reset batch totalizer	no change	reset
11	printing	not printing	printing
12	write privileges	no	yes
13	system configured	not configured	run mode
14	mode	calibration mode	run mode
15	totalizing	not totalizing	totalizing

### Bits 0 to 5: PID Status

These bits give the status of the product. For example Bit 0 is the mode of the PID 1 controller (if used). It indicates whether the PID is in manual or auto modes.

### Bit 6: Zero Status

Indicates whether the unit is currently performing a Zero calibration.

### Bit 7: Span Status

Indicates whether the unit is currently performing a Span calibration.

### Bits 8 to 11: Totalizer Status

Indicate “1” if the reset totalizer or print operations are taking place (these are momentary and will only stay set for a very short period).

### Bit 12: Write Privileges

Indicates whether the PLC can write parameters/commands to the product. This is controlled by parameter P799. If “1”, the PLC may change the Milltronics SmartLinx instrument’s parameters, if “0”, it can only read.

### Bit 13: Configuration Status

Indicates whether the unit is configured (all required parameters have been entered).

### Bit 14: Program Mode

Indicates program (calibration) mode, “0” = program mode, “1” = run mode

**Bit 15: Totalizing Status**

Indicates whether the unit is totalizing.

**Words 1, 2: Rate**

Contains the current rate reading in engineering units. See the Accumass BW500 manual for a full description of this reading.

**Words 3, 4: Load**

Contains the current load reading in engineering units. See the Accumass BW500 manual for a full description of this reading.

**Words 5, 6: Speed**

Contains the current speed reading in engineering units. See the Accumass BW500 manual for a full description of this reading.

**Words 7, 8: Total 1**

Contains the current value for totalizer 1 in engineering units. See the Accumass BW500 manual for a full description of this reading.

**Words 9, 10: Total 2**

Contains the current value for totalizer 2 in engineering units. See the Accumass BW500 manual for a full description of this reading.

**Word 11: Relay Status**

Shows the current logical status of all relays.

<b>bit</b>	04	03	02	01	00
<b>relay</b>	05	04	03	02	01

0 = relay not asserted

1 = relay asserted

“Asserted” indicates that the function controlling the relay is in an active state. Relay contacts can open or close based on this state, see your instrument manual for details.

## Word 12: Discrete Input Status

Shows the current logical status of all discrete inputs.

<b>bit</b>	04	03	02	01	00
<b>relay</b>	05	04	03	02	01

0 = discrete input open

1 = discrete input closed

## Word 13: Multispan Selection

Shows the currently selected span (1 to 4).

## Words 14, 15: PID 1 Setpoint Value

Contains the current setpoint value for PID 1 in engineering units. See the Accumass BW500 manual for a full description of this reading.

## Words 16, 17: PID 2 Setpoint Value

Contains the current setpoint value for PID 2 in engineering units. See the Accumass BW500 manual for a full description of this reading.

## Words 18, 19: Batch Setpoint Value

Contains the value of P564 – Batch Setpoint. See the Accumass BW500 manual for a full description of this parameter.

## Words 20, 21: Batch Pre-Warn Setpoint Value

Contains the value of P567 – Batch Pre-Warn Setpoint. See the Accumass BW500 manual for a full description of this parameter.

## Words 22 to 24: Parameter Number / Primary Index / Secondary Index, SPA

These words contain the last values written to words 0 to 2 of the write area. They confirm that the parameter value has been written. These words are not updated until the value has been successfully transferred and stored in the Milltronics SmartLinX instrument.

## Words 25, 26: Value, SPA

The value of the specified parameter and index.

## Word 27: Decimal Place, SPA

This word specifies the number of decimal places for the value in words 25/26.

Positive values indicate that the decimal place shifts to the left.

i.e. A 1 means that all returned values have the decimal place shifted 1 space to the left and a returned value of 5,213 is interpreted as 521.3.

Negative values indicate that the decimal place shifts to the right.

i.e. If this word is “-1”, a returned value of 5,213 is interpreted as 52,130.

### **Word 28: Format, SPA**

This word is always 0.

### **Word 29: Read / Write Flag, SPA**

This word mirrors the read/write word 7.

0 = read

1 = write

### **Word 30: Word Order**

The placement of the most significant word (MSW).

0 = MSW first

1 = MSW second

# Data Types

The Milltronics SmartLinX instrument parameters take on many values in various formats, as discussed in the Milltronics SmartLinX instrument manual. For the convenience of the programmer, those values are converted to and from 16-bit integer numbers, since those are easily handled by most PLCs.

## Integer

### Level Products

Integer parameter values are by far the most common. For example, parameter P920 (Reading) returns a number representing the current reading (either level or volume, depending on the Milltronics SmartLinX instrument configuration).

Numeric values may be requested or set in units or percent of span, and may be specified with a number of decimal places.

Numeric values must be in the range -20,000 to be +20,000 to be valid. If a parameter is requested and its value is more than +20,000, the number 32,767 is returned; if it is less than -20,000, the number -32,768 is returned. If this happens, increase the number of decimal places for that parameter.

If a parameter cannot be expressed in terms of percent (e.g. span), or has no meaningful value, the special number 22,222 is returned. Try requesting the parameter in units, or refer to the Milltronics SmartLinX instrument manual to understand the format and use of the requested parameter.

### Mass Dynamics Products

Integers used on the Mass Dynamics products can have any valid value. So, the entire range from -32,768 to 32,767 or 0 to 65,535 is available and no values are used as error conditions.

## Bit Values

Bits are packed into registers in groups of 16 bits (1 word). In this manual bits are numbered from 00 to 15, with bit 00 referring to the least significant bit and bit 15 referring to the most significant bit.

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
MSB															LSB

## Unsigned Double Precision Integer (UINT32)

### Note:

Used for Mass Dynamics products only.

Large numbers are put into unsigned 32-bit integers. By default they are set up so that the first word (register) is the most significant word (MSW) and the second word (register) is the least significant word (LSW) depending on the setting of the word order bit.

For example, when reading words 7 and 8 on the Mass Dynamics block (Total 1), the 32 bits would look like the following:

word 7			word 8		
15	MSB	0	15	LSB	0
31	32-bit integer value (UINT32)				0

The whole is read as a 32-bit integer.

## Split Values

### Note:

Used for Level products only

Certain parameters are actually a pair of numbers separated by a colon, in the format xx:yy.

### One example is P807, Transducer Noise, where:

xx = the average noise value in dB.

yy = the peak noise in dB.

The number which corresponds to xx:yy, either for reading or setting a parameter, is determined by the following formula:

### For storing to the Milltronics device:

value =  $(xx + 128) \times 256 + (yy + 128)$

### For reading from the Milltronics device:

xx =  $(\text{value} / 256) - 128$

yy =  $(\text{value} \% 256) - 128$

### Where:

% is the modulus operator.

The modulus can be computed by following these steps:

value<sub>1</sub> = value / 256

value<sub>2</sub> = remainder of value<sub>1</sub>

value<sub>3</sub> = value<sub>2</sub> x 256

yy = value<sub>3</sub> - 128



**It may simplify programming to notice:**

xx = (most significant byte of value) – 128

yy = (least significant byte of value) – 128

## Text Messages

**Note:**

Used for Level products only

If a Milltronics device parameter returns a text message, that message is converted to an integer and provided in the register. The numbers are shown in the 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
30011	lo
30012	hi
30013	de
30014	en
30015	- - - - (parameter has not been set)
-32768	value is less than -20,000
32767	value is greater than 20,000

## Relay Function Codes (P111 in Level Products Only)

If a Milltronics instrument parameter returns a relay function code, that message is converted to a number and provided in the register. The numbers are shown in the table below:

Relay Function Code	Number	P111
off, relay not used	0	0
undesignated level alarm	1	1
low-low level alarm	2	1 – LL
low level alarm	3	1 – L
high level alarm	4	1 – H
high-high level alarm	5	1 – HH
in bounds alarm	6	2
in bounds alarm	7	2 – B1
in bounds alarm	8	2 – B2
out of bounds alarm	9	3
out of bounds alarm	10	3 – B1
out of bounds alarm	11	3 – B2
rate of level change alarm	12	4
rate of level change alarm	13	4 – R1
rate of level change alarm	14	4 – R2
temperature alarm	15	5
loss of echo (LOE) alarm	20	6
transducer cable fault alarm	16	7
pump efficiency alarm	17	8
clock failure alarm	18	9
time of day alarm	19	10
pump failure alarm	21	11
totalizer	22	40
flow sampler	23	41
fixed duty assist	25	50
fixed duty backup	26	51
alternate duty assist	30	52
alternate duty backup	31	53
service ratio duty assist	35	54
service ratio duty backup	36	55
first in first out (FIFO)	40	56
time	45	60
overflow	50	61
aeration	55	62
gate	60	63
flush valve	65	64
communication	66	65
pump failure alarm	70	11
power failure alarm	71	12
unknown function	200	

See the manual for the Milltronics SmartLinX instrument for full information on P111.

## Generally

In all cases, first check that the SmartLinX module has passed its on-going built-in self test (Milltronics SmartLinX instrument parameter P790). The result should be “pass”.

If “fail” is indicated, either the module is defective, or the module connector on the Milltronics SmartLinX instrument is defective.

If “err1” is indicated, the Milltronics software doesn’t recognize the ID number of the installed module. Please contact Milltronics or your distributor for instructions and/or upgraded Milltronics SmartLinX instrument software.

Make sure the Milltronics device is set to a unique address, and does not conflict with any other slave(s) on the bus.

Check the configuration of the scanning master, and make sure it is functioning properly.

### **1. I have configured the Milltronics device in the Master and downloaded it to the processor, but the device is not coming on line.**

- Check which GSD file you use, and make sure you used the correct one (see GSD Files on page 17).
- Check the wiring to the card. In particular, check that you have line A and B connected correctly.
- Verify that you set the correct address on the card. Also, please note that the card does not see a charge until the power has been cycled.

### **2. The network was working fine until we connected to the Milltronics device, at which time, other devices dropped out.**

- Check the termination switch on the Profibus card. The network cable has to be terminated at both ends of the LAN, but not in between.
- Check your grounding. The Profibus specifications require that all devices be on the same ground. Improper grounding can cause strange things to happen.



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