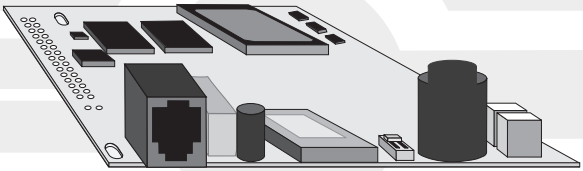
MILLTRONICS

SMARTLINX INTERFACE MODULE
FOR TELEPHONE LINE MODEM

Instruction Manual PL-581 April 2001



SmartLinx®

33455810
Rev. 1.3

SMARTLINX INTERFACE MODULE

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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1954 Technology Drive, P.O. Box 4225
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Regulatory Compliance

FCC Part 15

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

FCC Part 68

This equipment complies with Part 68 of the FCC rules. On the top of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company. The REN of the SmartLinx Modem is 0.9B.

This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant and an FCC compliant telephone cord and modular plug. An applicable registration jack for use with the equipment is RJ11C. See installation instructions for details.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this SmartLinx Modem, for repair or warranty information, please contact Milltronics Inc., 709 Stadium Drive, Arlington, Texas 76011, 1 (817) 277-3543. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

The equipment cannot be used on public coin phone service provided by the telephone company. Connection to party line service is subject to state tariffs (Contact the state public utility commission, public service commission or corporation commission for information).

Industry Canada CS03

Note: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service must be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorised Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution:
Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

CTR 21

The equipment has been approved to Directive 98/482/EEC for pan-European single terminal connection to the Public Switched Telephone Network (PSTN). However, due to differences between the individual PSTNs provided in different countries the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point. In the event of problems, you should contact your equipment supplier in the first instance.

Approved Uses

For CTR21 compliance, the Country Code parameter must be set to TBR21.

You may connect this equipment to:

- To two-wire Public Switched Telephone Network direct lines employing loop disconnect or tone (DTMF) dialling.
- To extension lines of compatible PBXs, including PBXs that return secondary proceed indication. Consult supplier for an up to date list of compatible PBXs.

You may not connect this equipment to:

- To shared service (party) lines
- As an extension to a pay phone

This apparatus has been approved for the use of the following facilities:

- Operation at V.32bis, V.32, V.22bis, V.22, V.23 and V.21
- Audio Call Progress monitoring via an internal loudspeaker
- Automatic call initiation
- Auto-Answer
- Detection of Initial Proceed Indication and operation with or without it
- Detection of Secondary Proceed Indication
- Detection of the following tones: DIAL, BUSY and RING
- Loop disconnect and DTMF signalling

Any other usage will invalidate the approval of the apparatus, if as a result, it then ceases to conform to the standards against which approval was granted.

Electromagnetic Compatibility

This device complies with the following standards in accordance with the European Directives 89/336/EEC.

Emission: EN 50081-2 (1994)
Immunity: EN 50082-2 (1994) and EN 61000-6-2 (1999)

Safety

This device complies with the following standards in accordance with the European Directives 91/263/EEC.

IEC 950 2nd edition including amendments 1, 2,3 & 4 (EN60950)

Specifications

Application:

- compatible with Modbus RTU/ASCII instruments that use function codes 03, 06, 16

Compatible Instruments:

- AiRanger XPL Plus

Communication Settings:

data rate:

- 1200, 2400, 4800, 9600, 14400

parity:

- none, odd or even

stop bit:

- 1 or 2

data bits:

- 8 or 7

protocol:

- Modbus™ RTU / ASCII, automatically detected

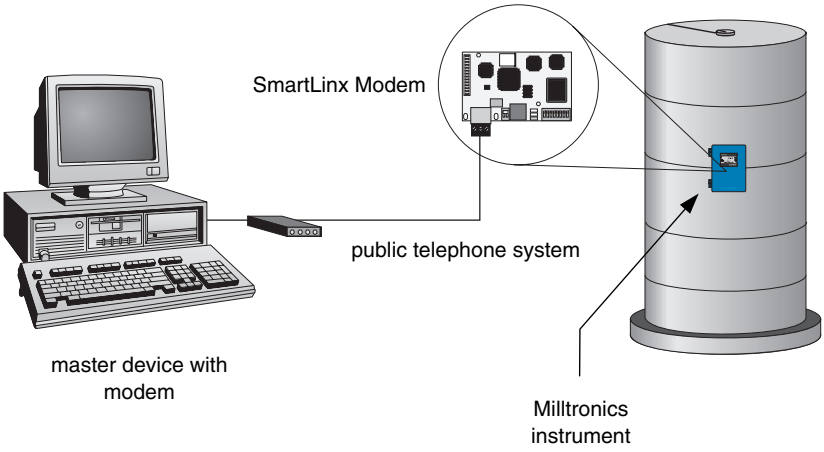
Telephone Interface:

- RJ11C

About the SmartLinx Modem…

Milltronics SmartLinx® Modem is a module designed to interface a Milltronics SmartLinx compatible device to a Modbus RTU/ASCII master device via a modem connection.

Modbus RTU/ASCII is an industry standard protocol that is supported by many different devices. A brief description of the protocol and the Milltronics memory map are outlined in Chapter 3 of this manual.

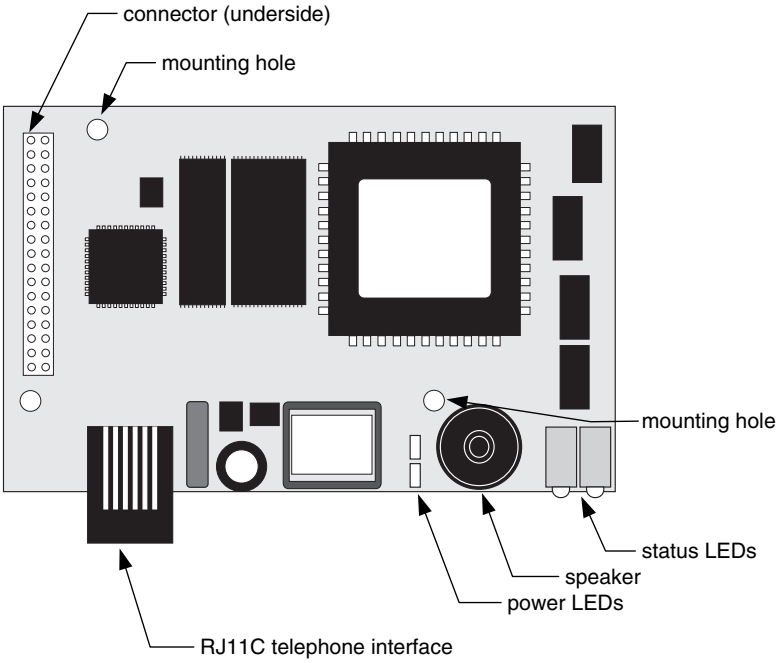


Installation

The SmartLinx module may have been either shipped installed in your unit or separately for on-site installation. Refer to the manual for the Milltronics host instrument for details on module location and physical installation.

Compatibility

- AiRanger XPL+



Cable Connection

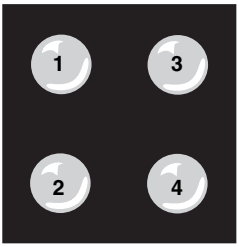
Uses a standard RJ11C telephone interface.

Operation

There are two sets of Operation LEDs:

- **Status LEDs** located on the bottom-right of the module
- **Power LEDs** located on the bottom-centre of the module

Status LEDs



1. **Status Light**
   Red on start up
   Blinks green when operating normally
   Red (continuous or blinking) on fault condition

2. **Off Hook**
   Solid green when off hook (connected)
   Off (unlit) when on hook (disconnected)
   Blinks Red when modem circuitry is reset

3. **Receive**
   Pulses green when the module is receiving data

4. **Transmit**
   Pulses green when the module is transmitting data

Power LEDs

Both small LEDs should be green when the unit is powered. If neither of the LEDs is illuminated then replace the module.

Communications Setup

General

The following parameters must be defined in the Milltronics instrument to establish successful communication. Instructions on how to set up these parameters are found in the manual for the host instrument.

Wiring is handled through modular telephone (RJ11C) connections.

Modbus Type (RTU or ASCII)

The module will automatically detect whether the protocol is Modbus ASCII or Modbus RTU. No configuration is required for this.

Configuration of the Master Modem

The Modbus Master modem should be a 14400 bps or faster (depending on data rate selected) modem. Also the modem should be set up with no data compression or error-correction.

A number of modems have been tested with the SmartLinx modem and there are Application Guides that outline how to set them up.

Specific Parameters

(*f*) indicates factory preset

The SmartLinx Modem handles data in 10-bit segments. These segments consist of one start bit, data bits, an optional parity bit, and stop bit(s). Ensure that parameters 752, 753, 754 total nine bits.

In most cases the parameter defaults should work.

P751 Requested Data Rate

Sets the initial data rate of the modem.

Once a connection is made, the SmartLinx modem will negotiate the actual data rate with the remote modem (see P793).

Values:

2 = 1200 bps
3 = 2400 bps
4 = 4800 bps
5 = 9600 bps
6 = 14400 bps *f*

P752 Parity Mode

Sets the parity mode.

Values:

0 = no parity
1 = odd parity
2 = even parity
3 = mark
4 = space

P753 Data Bits

The number of data bits per character.

Values:

7 or 8
Preset: 8

P754 Stop Bits

The number of bits between the data bits.

Values:

1 or 2
Preset: 1

P755 Slave Address

The unique identifier of the SmartLinx instrument.

Values:

1 to 247
Preset: 1

P756 Country Code

The identifier of the country in which the modem is connected.

This parameter sets the modem for the different phone systems in different countries.

Values:

Australia	9	Italy	89
Austria	10	Japan	0
Belgium	15	Mexico	181
Canada	181	Norway	130
China	181	Portugal	139
Denmark	49	Singapore	156
Finland	60	Spain	160
France	61	Sweden	165
Germany	66	Switzerland	166
Greece	70	TBR21	253
Holland	123	UK	180
Ireland	87	US	181

Note:
Inclusion in this list does not guarantee approvals for a specific country. Contact your Milltronics representative for use in your country.

P757 Modem Inactivity Timeout

Sets the time in seconds that the SmartLinx module holds the connection open with no activity.

This parameter forces a disconnection if too many seconds elapse without any valid occurrence of master to slave communication.

0 disables the inactivity timer.

Values:
0 to 9999
Preset: 0

P758 Interframe Spacing – Receive

The silent time expected, in milliseconds, between two adjacent data packets (that is, master to slave transaction queries).

Note:
Both P758 and P759 are for advanced troubleshooting only. Most applications will require the preset value.

0 selects the traditional 3 and one-half characters (recommended) as the time interval that separates one command from the next.

Any value from 1 to 250 specifies the time in milliseconds.

Values:
0 to 250
Preset: 0

P759 Interframe Spacing – Transmit

The silent time expected, in milliseconds, between two adjacent data packets (that is, slave to master transaction responses).

Note:
Both P758 and P759 are for advanced troubleshooting only. Most applications will require the preset value.

0 selects the traditional 3 and one-half characters (recommended).

Any value from 1 to 250 specifies the time in milliseconds.

Values:
0 to 250
Preset: 0

P793 Actual Data Rate (View Only)

Shows the actual data rate used for communications.

This data rate may differ from the Initial Data Rate (P751) as the modems can negotiate to a lower data rate when connecting (that is, fall back and fall forward).

Values:
0 = not connected
2 = 1200 bps
3 = 2400 bps
4 = 4800 bps
5 = 9600 bps
6 = 14400 bps

P795 Module Type (View Only)

Shows the protocol supported by the installed SmartLinx module.

If the number shown is anything other than 133, then the SmartLinx module is not a modem and you should contract your local Milltronics representative.

Values:
133 = Modem Modbus RTU/ASCII

P796 SmartLinx Software Version (View Only)

Shows the software version in the SmartLinx module.

Application Layer

Modbus RTU/ASCII is an industry standard protocol owned by Schneider Automation Inc.[1] and is used throughout process control industries for communication between instruments. Modbus RTU/ASCII is a master-slave type protocol. An instrument with a SmartLinx Modem module is a slave unit.

A brief description of Modbus RTU/ASCII is given in this manual. For a full description of the Modbus RTU/ASCII protocol, contact Groupe Schneider, or see the Modicon web site (www.modicon.com).

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

Parameter Indexes

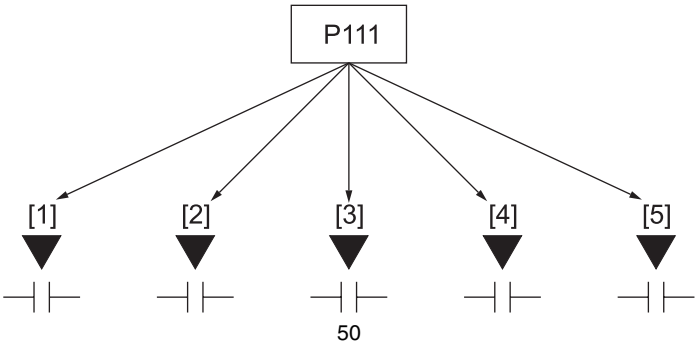
Most parameters used on Milltronics SmartLinx instruments are indexed. Indexing allows a parameter to relate to more than one input or output. For example, many parameters are indexed by measurement point while others are indexed by relay output or discrete input.

Primary Index:

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

Examples of primary indexes are:

P111[3] = 50 means:
P111 (Relay Control Function) for relay 3 is set to value 50



[1] Modicon is a registered trademark of Groupe Schneider.

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).

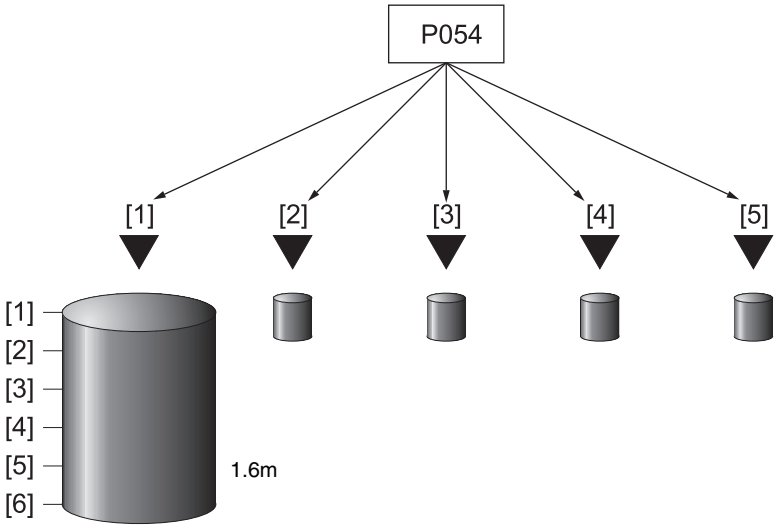
The primary index is called a point on some older Milltronics products.

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.

The secondary index is called a mark on some older Milltronics products.

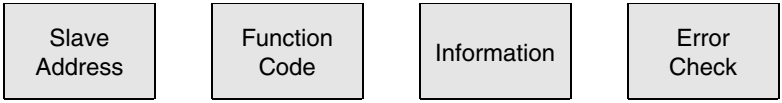
How Modbus RTU/ASCII Works

As mentioned previously, Modbus RTU/ASCII is a master-slave type protocol. This is also sometimes 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 the slave instruments. This is done using a “function code” which indicates the information or the action being requested. The slave instruments are not permitted to talk unless they have been asked for information. When responding, the slave will either give the information

that the master has requested or send back an error code which would either say why it cannot give the information or that it did not understand the request.

Modbus RTU/ASCII was designed for communication between PLCs and sensing instruments. Therefore, the protocol refers to inputs, outputs, coils, registers, and forcing. For our purposes, everything has been mapped into holding registers so that Modbus RTU/ASCII function code 03 can read them and Modbus RTU/ASCII function codes 06 and 16 can write to them.

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



Where:

Slave Address	the network address (P753) of the slave you are talking to
Function Code	number that represents a Modbus RTU/ASCII command. As described above, the SmartLinx modem supports function codes 03, 06, and 16
Information	register data, depending on the function code
Error Check	cyclical redundancy check (CRC) for RTU 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, please refer to the Modbus RTU/ASCII specifications.

Register Mapping

SmartLinx Modem only works with the compatible Milltronics SmartLinx instruments (see page 13). These instruments range from one to 10 points of measurement. As such, this manual covers the maximum 10 point measurement capability. If your instrument has fewer than 10 points, ignore data in registers associated to non-existing points of measurement. These registers are present but they contain undefined values.

Note:
Parameter P999 (Master Reset) is not accessible via the SmartLinx interface.

Data Access Methods

Modbus master units may be PLCs, PCs or DCS controllers. There are three different methods available to access the values in the register table as shown in Register Map – Level Products on page 27. They are:

- Direct Access – changes the operating mode, read status or the measurement point value
- Multiple Parameter Access (MPA) - allows you to monitor a single parameter on index points 1 to 10. Using these words does not allow the changing of parameter values.
- Single Parameter Access (SPA) - any value in the Milltronics product can be read or written.

The use of these methods is detailed in the following sections.

Note:
The design of the SmartLinx module requires that a maximum delay of 0.1 seconds between the time that the master writes a value to the time that it can read the response. Ensure that the master device accounts for this delay.

Direct Access

Certain values are mapped directly into words. These words can be monitored continuously.

Multiple Parameter Access (MPA)

This is a hand-shaking method where the master device writes the parameter number, secondary index, decimal place, and format. Then, the SmartLinx host instrument provides the values of the requested parameter for primary indexes 1 to 10. Unused index values are left blank.

Note:
In Milltronics' products, the memory is arranged as Parameter number, Primary Index, Secondary Index.

Using Multiple Parameter Access (MPA)

MPA allows you to monitor a single parameter on index points 1 to 10. Using the MPA registers does not allow the changing of parameter values.

1. Write the values into registers 40032 to 40035 to define the requested information.

2. Monitor the input registers (40032 to 40035). When the values returned match those that were written, go to step 3.

3. Read the requested values in registers 40022 to 40031. These values are continuously updated. Continue reading from these registers until new values are required. At that time, go back to step 1.

> **Note:**
> MPA values are only updated in Run mode (register 40044 = 0).

Parameter Indexing with MPA

Primary Index

The primary index is implicit in the memory address. MPA values are returned through registers 40022 to 40031 of the register map (see page 27).

register	index
40022	1
40023	2
40024	3
40025	4
40026	5
40027	6
40028	7
40029	8
40030	9
40031	10

Secondary Index

The secondary index for the requested parameter is specified in register 40033.

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

Single Parameter Access (SPA)

This is a hand-shaking method where the master device 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)

Words 40036 through 40043 are used for SPA, allowing continuous monitoring or demand programming of a parameter.

Monitoring a Parameter Value

1. Set register 40043 to 0, “read.”

2. Write the required parameter information to registers 40038 through 40042.

3. Monitor the address variables that are reflected back in registers 40038 to 40042. When the values returned match those that were written then go to step 4.

4. Read the requested value from register 40036. This value is continuously updated. Continue reading from this word until a new value is required. At that time, go back to step 1.

Programming a Parameter Value

1. Write the required parameter information to registers 40037 through 40042, including the new parameter value (register 40037).

2. Set word 40043 to 1, “write”.

3. Monitor the values in registers 40037 to 40042. When the values returned match those that were written then the requested write operation is proceeding.

4. Read the value in register 40036 to confirm that the correct value has been written.

5. Set register 40043 back to 0 “read”.

Note:
Parameters should only be written in Program mode. Ensure register 40044 = 1.

Parameter Indexing with SPA

Primary Index

The primary index is specified in register 40040.

Secondary Index

The secondary index is specified in register 40039.

Register Map – Level Products

Registers	Description	Access	Data Type
40001	point status (read only)	direct	bitmapped
40002 – 40011	point reading (read only)		integer
40012 – 40021	point alarm and status (read only)		bitmapped
40022 – 40031	returned values (read only)	MPA	integer
40032	parameter number		integer
40033	secondary index		integer
40034	decimal place		integer
40035	format		integer
40036	current value (read only)	SPA	integer
40037	new value		integer
40038	parameter number		integer
40039	secondary index		integer
40040	primary index		integer
40041	decimal place		integer
40042	format		0/1
40043	write flag		0/1
40044	operating mode	direct	0/1
40045	point on priority		bitmapped

R40001: Point Status (read only)

bit	Description
00-09:	**measurement point status** Indicate the operation of the points 1-10.

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

If a bit status is 0, the corresponding point is deemed to be operational based on the criteria defined by R40012-R40021, bits 01-04. If the bit status is 1, then the corresponding point is deemed non-operational. To further diagnose a point's operation, examine the corresponding point alarm and status R40012-R40021.

If a bit status is 1, then for the corresponding point alarm word, one or more of the alarm bits 01-04 are also 1 to indicate the operational problem.

10:	**operating mode** 0 = instrument in 'run' mode 1 = instrument in 'program' mode
11-15:	**Reserved:** These bits are undefined.

R40002-R40011: Point Reading (Read Only)

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 instrument documentation for a definition of 'P920'.

Note that these values may contain numeric level data for inoperative or malfunctioning points; refer to R40001 point status, and R40012-R40021 point alarm and status for the actual operational status of the measurement points.

R40012-R40021: Point Alarm and Status (read only)

These words contain the corresponding alarm and status bits for point 1 to 10. So R40012 = measurement point 1 and R40021 = measurement point 10.

Bit status:

0 = false
1 = true

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

R40022-R40031: Returned Values, MPA (read only)

These words contain values requested by writing to R40032-R40035. The type of data and format are specified with that request (see below). In this, the index number 1-10, corresponds to R40022-R40031. So R40022 = measurement point 1 and R40031 = measurement point 10.

R40032: Parameter Number, MPA

Specifies the parameter number for the returned value in R40022-R40031.

R40033: Parameter Secondary Index, MPA

Specifies the parameter index for the value returned in R40022-R40031. This word is ignored for parameters which don't use indexes.

Some specific Milltronics instrument parameters use indices to address the multiple values stored within the single parameter. See Parameter Indexes on page 21 for details.

Note:
The primary index is implicit in the word location where register 40022 = index 1 and register 40031 = index 10.

R40034: Decimal Place, MPA

Specifies the number of decimal places that the returned values are shifted. This affects words R40022-R40031.

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. for example if this word is -1, a returned value of 5,213 is interpreted as 52,130.

R40035: Format, MPA

This word sets the format for the returned values.

Values:
0 = normal
1 = percent of span

R40036: Current Value, SPA (read only)

This word is the current value of the parameter specified in the SPA area R40038-R40042.

R40037: New Value, SPA

This is the new value for the parameter specified in R40038-R40042. To verify the write check that R40036 returns the value that was written here.

Word R40043 must be set to “1” to enable the write.

R40038: Parameter Number, SPA

Specifies the parameter number.

R40039: Parameter Secondary Index, SPA

Specifies the secondary index for the parameter specified by R40038. This word is ignored for parameters which don't use multiple indexes. See Parameter Indexes on page 21 for details.

R40040: Parameter Primary Index, SPA

Specifies the primary index number for the parameter specified by R40038. See Parameter Indexes on page 21 for details.

R40041: Decimal Place, SPA

Specifies the number of decimal places that the returned values are shifted. This affects words R40037 and R40036.

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. for example if this word is -1, a returned value of 5,213 is interpreted as 52,130.

R40042: Format, SPA

This word sets the format for the value in R40036, R40037.

Values:

0 = normal
1 = percent of span

R40043: Read / Write Flag, SPA

This word determines whether the master system is reading a value from R40036 or writing a value to R40037. It is good practice to confirm the write by reading current value R40036 and then reset this register to zero.

Values:

0 = read parameter value in R40036
1 = continually write new value to R40037 until reset to 0

R40044: Operating Mode

This word sets the operating mode of the Milltronics instrument. The instrument changes mode only when the status of the bit changes.

The operating mode is also set via the instrument keypad.

Bit status

0 = run mode
1 = program mode

R40045: Point-on-Priority

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

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

Bit status

0 = normal
1 = priority

e.g.

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

…shows that measurement points 3 and 1 are on priority scan

All other bits are reserved and should contain 0.

If this word is used to control point-on-priority, then the Milltronics instrument must be configured to permit this. Parameter P720 must be set to 1 (manual, BIC-II or SmartLinx) for each point to permit priority control for that point. To enable priority control for all points, store ‘1’ to parameter P720, point ‘0’.

Data Types

The Milltronics 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

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 either 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 host instrument manual to understand the format and use of the requested parameter.

Bit Values

Bits are packed into registers in groups of 16 bits (1 word). In this manual we number the bits from 0 to15, with bit 0 being 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

Split Values

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 instrument:

value = (xx + 128) x 256 + (yy + 128)

For reading from the Milltronics instrument:

xx = (value / 256) – 128
yy = (value % 256) – 128

Where:

% is the modulus operator.
The modulus can be computed by following these steps:

$value_1$ = value / 256
$value_2$ = remainder of $value_1$
$value_3$ = $value_2$ x 256
yy = $value_3$ - 128

It may simplify 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 instrument 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 Only)

Note:
Used for 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
Non-sequenced Pump Control	25	50
unknown function	200	

See the manual for the host instrument for full information on P111.

Modbus RTU/ASCII Error Codes

With the memory map (detailed in Register Mapping on page 21), a write operation to a read only register has no result. No error code is generated and the value is ignored. If the user tries to access an invalid parameter to write a read only parameter by using MPA or SPA, then no error code will be generated and for the read, a value of some sort will be returned, for a write, the value will be ignored.

Appendix A: Troubleshooting

Generally

In all cases, first check that the SmartLinx Modem has passed its on-going built-in self test (device parameter P790). The result should be PASS.

If FAIL is indicated, either the module is defective, or the module connector on the Milltronics device 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 compatible device software.

Check P795 to make sure that it is equal to 133 (Modem Modbus RTU/ASCII). If this parameter is showing any other number then you have the wrong SmartLinx card.

Specifically

Q1: I tried to set a Milltronics device parameter using a SPA write, but the parameter remains unchanged.

A1.1: Some parameters can only be changed when the Milltronics device isn't scanning. Try putting the Milltronics device in program mode, using operating mode R40044.

A1.2: Try setting the parameter from the keypad. If it can't be set using the keypad, check the lock parameter (P000).

Q2: My Master connects OK to the SmartLinx Modem, but I'm not getting responses for all queries.

A2.1: Try increasing the value of P758 Interframe Spacing – Receive to at least 15 (msec). Modems often introduce delays greater than 3.5 character times which systems can interpret as interframe spaces. This can cause an affected system to look for a new frame when it is still in the middle of the previous one, causing communication errors.

A2.2: There may be excessive noise on the phone line. Try setting P751 Requested Data Rate to a lower value, and re-dialing from the Master.

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www.milltronics.com

MILLTRONICS

Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, ON.Canada K9J 7B1
Tel: (705) 745-2431 Fax: (705) 741-0466
www.milltronics.com

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