



User Guide and Installation Manual

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ALL	REV 0	06/03	INITIAL SMALL FORMAT MANUAL
ALL	REV 1	01/05	COMPLETE REWRITE
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ALL	REV 1.03	07/05	ADDED FBXlator
ALL	REV 1.04	03/06	UPDATED MSFBXlator

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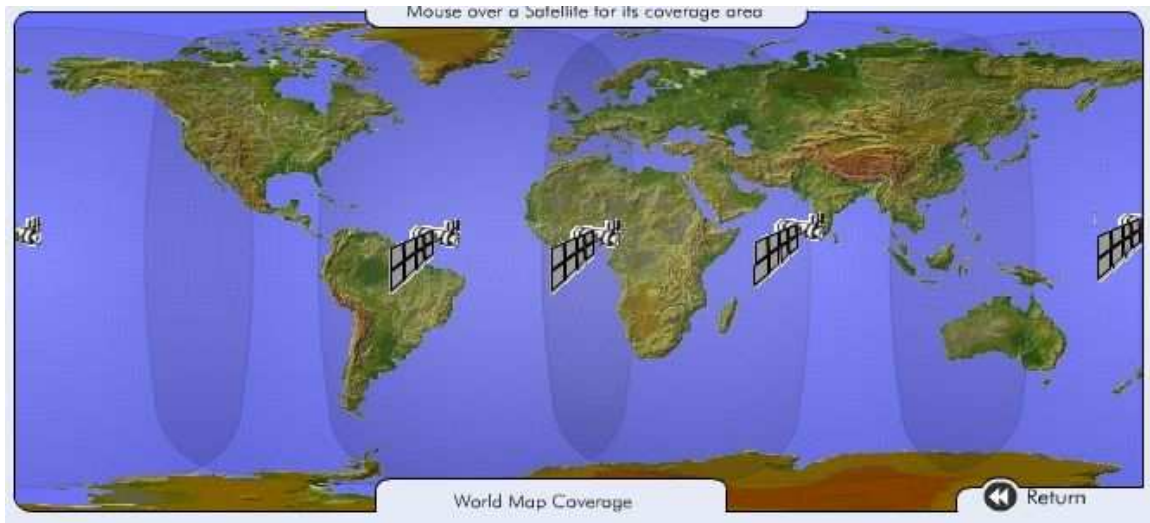
MeterStar User Guide and Installation Manual

Overview

MeterStar provides a simple and effective communication method for an Electronic Gas Meter (EGM). Using the latest technology in Satellite communications, MeterStar transports data from an EGM located virtually anywhere in the world and provides the information to your desktop wherever you have the Internet available.

This manual provides the information required to understand the MeterStar product and how to install the device for best performance. Its intended use is for both the installer and the end user of the equipment.

MeterStar uses the INMARSAT satellite network to provide world wide coverage through a network of geostationary satellites placed around the equator that provide optimum coverage.



The INMARSAT's D-Plus (D+) mode is used by MeterStar as a high performance low cost communication medium. This mode is supported with the DMR-200 terminal. The Crystalline Technology developed interface communicates with the DMR-200 and handles the required overhead associated with formatting and packing data obtained from the customer supplied Electronic Gas Computer (EGM) or other Remote Terminal Unit (RTU). In addition, MeterStar has 5 I/O points that can be configured for Analog Input (0 to 5 VDC), Digital Input, or Digital Output. Through simple wiring other configurations such as 1 to 5 VDC or 4 to 20mA circuits are supported.

To support the DMR-200 terminal, the MeterStar board acts as a host to the connected EGM device. It periodically polls the device to obtain critical information as defined by the customer application. It analyzes this data and then, based upon predetermined rules,

sends the information to the host system. These rules are based upon alarm set-points, time of day, by detection of an event, or as a result of being polled by the host system.

A typical application polls the EGM at frequent intervals, such as once per minute, for current flowing conditions. For a natural gas orifice measurement application this includes current differential pressure, line pressure, temperature, and flow rate. Each of these reading is compared against a possible alarm set-point defined in the MeterStar board. If any of the values are found to be in alarm, an immediate transmission is made to the host system at <http://www.MeterStar.com> where various forms of alarm notification are employed to notify the customer.

If no alarms are present the unit typically polls the EGM for critical gas measurement information such as BTU, Specific Gravity, N₂, CO₂, pipe diameter, and orifice plate size. It then compares these readings with the reading from the previous poll. If MeterStar determines that one or more of these parameters changes, it transmits the information to the host thus providing historical record of such changes.

For certain critical applications, MeterStar checks the current time. If an update is required, MeterStar sends the current flow information to the host computer. This is very valuable for certain applications such as when a 'Morning Report' is desired early in the morning prior to the end of a contract day. This allows field personnel to identify possible problems in the field and to optimize their days travel requirements and maintaining production goals.

Finally, MeterStar checks the time of the EGM and its internal contract hour setting. If MeterStar determines that a contract hour has passed, it polls the EGM for the prior day's production and again transmits this information to the host computer. Now the producer, pipeline operator, or distribution company has a record of the flow and can appropriately operate the system in an efficient manor.

Most importantly, MeterStar is a complete solution that provides communications and reporting services without the traditional requirement of expensive towers, networks, and host systems. For users who only want the communication, MeterStar can be configured to provide data to your host to meet other reporting requirements.

Crystalline Technology, Inc MeterStar system eliminates all the complexities of traditional SCADA (Supervisory Control And Data Acquisition) systems. Quite simply, install MeterStar on your challenging locations and you will have communications where other systems fail due to coverage, cost, or both.

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Safety Notice

This manual provides generalized guidelines for successful installation and operation of the MeterStar product. Planning and prudent procedures help to ensure a smooth installation. The MeterStar interface electronics and the DMR satellite terminal are approved for Class 1, Division 2, Groups C & D applications when properly installed and maintained.

Class defines the general nature of the hazardous material in the surrounding atmosphere. Class 1 is for locations where flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Division defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere. Division 2 locations are presumed to be hazardous only in abnormal situation.

Group defines the hazardous material in the surrounding atmosphere; Group C is for atmosphere containing ethylene, gases or vapors of equivalent hazard. Group D is for atmosphere containing propane, gases or vapors of equivalent hazard.

In order for MeterStar to meet and be approved for hazardous locations, it must be installed according to the National Electric Code (NEC) article 501.

Local, state, and federal codes often place restrictions on locations that are suitable for this type of equipment and may have requirements of locating the equipment a certain distance from a meter run, pipe flanges, and hazardous area classifications.

When installing units in a hazardous area, make sure components selected are labeled for use in such areas. Installation and maintenance must be performed only with the area is known to be non-hazardous.

Note:

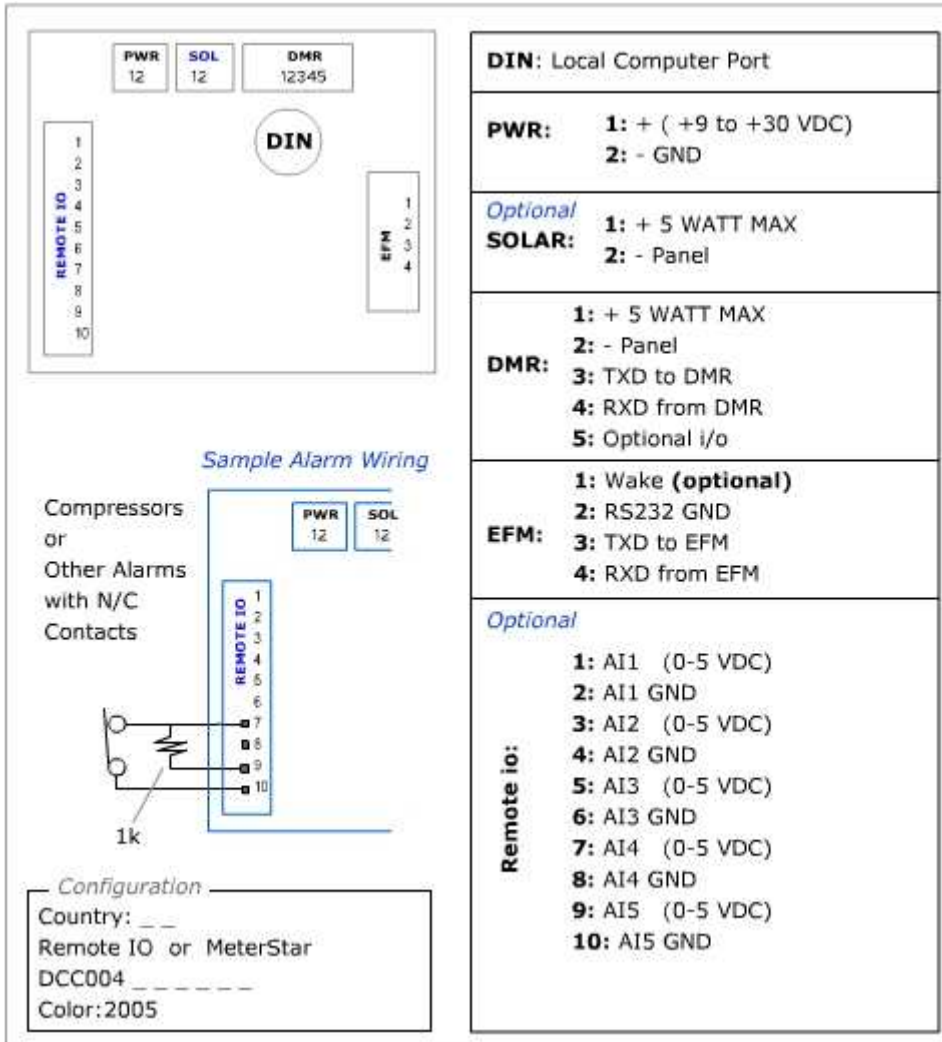
Refer to your local codes for specifics in meeting and maintaining compliance.

Typical sources of primary power for the MeterStar are line power and solar power. Adhere to all local and National Electrical Code (NEC) requirements for line power.

Local wiring is site and application dependant. There may be regulatory requirements that mandate certain techniques and methods including burial, conduit, armored cable, or overhead cables may be appropriate for your installation.

Quick Start

Figure 1 (board terminations)



Specifications

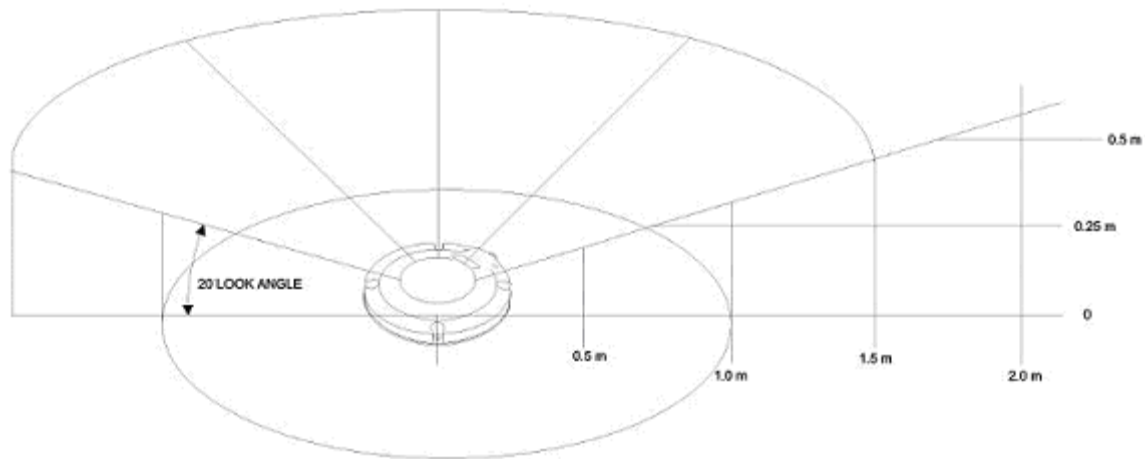
	Minimum	Maximum	Units
Power Requirements:	9	30	DC Volts
Operating Temperature:	-55	125	Deg C
Storage Temperature:	-65	150	Deg C
Current Requirement:	2	1000	mA
Typical Average Current	20		mA
Analog Inputs	0	5	DC Volts
Input Protection		10	Amp Fast Acting TSR
Serial Interface		2	RS-232
Baud Rate	48	19200	Baud (Selectable)

Installation:

Locate a suitable place to mount the MeterStar equipment so the DMR-200 Satellite transceiver has a clear and unobstructed view of the sky where the satellite is located. Since the satellite is in geostationary orbit it is always located in the same spot in the sky. You may want to visit:

http://www.star-traxx.com/html/st_inmarsat.shtm

This site allows you to move the mouse around on a map of the earth to the general area where you intend to install the equipment. It provides the elevation and azimuth of the satellite providing the best coverage for your location. For elevation angles less than 20 degrees, the unit should be tilted to provide best performance. If you are utilizing our turn-key MeterStar package with integrated solar panel you should tilt the assembly appropriate for the best solar performance of the collector. This generally works quite well for performing excellent satellite coverage at the same time.



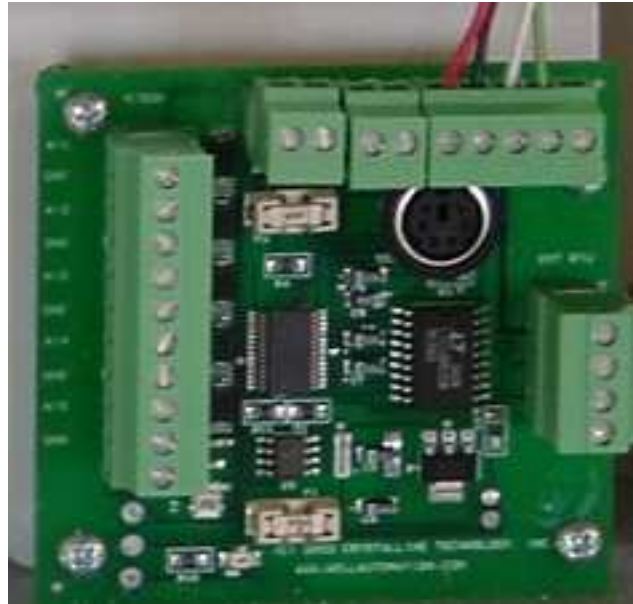
Elevation View to Satellite

Other considerations may be pertinent such as wind load, snow or ice build up, obstructions and physical mounting surfaces.

Typical Configuration:



For most installations only 3 wires are required to connect the MeterStar to the Electronic Gas Flow (EGM) computer for RS-232 communications. MeterStar is preconfigured for the specific EGM used. All connections are made on the MeterStar processor board as shown below:



The 4 pin ‘Phoenix’™ connector located on the right side of the board is used to connect to the EGM as follows:

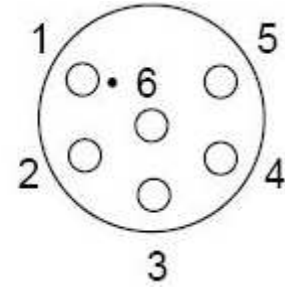
Pin	Label	Function
1	WAKE	Wake (only required on certain units)
2	GND	Ground
3	TX	RS-232 Transmit to EGM
4	RX	RS-232 Receive from EGM

Refer to the appropriate appendix for notes on configuring the EGM to work with the MeterStar board.

Power should be provided to the top left 2 pin ‘Phoenix’™ connector (T2). Power should be capable of sustaining 9 to 30 VDC with a constant load of 20mA and a peak load of 700mA during the actual transmission of data. A second 2 pin ‘Phoenix’™ next to the power is for applications where a small solar panel charges a battery connected to T2. Although a protective diode is provided to prevent reverse current flow at night, a solar regulator should be used if appropriate.

For OEM and custom installations where the DMR-200 is not pre-wired from the factory, you should connect it to the MeterStar board. The DMR-200 utilizes a round ‘Conxall’™ connector (part number Conxall MINI-CON-X® 6282-6PG-3xx). The pin out on the DMR-200 is as shown below:

Pin 2	RS-232 Tx Data to user
Pin 3	RS-232 Rx Data from user
Pin 4	Ground and Shield
Pin 5	Input Power +9 to +30 VDC



Pins 1 and 6 are not used with the MeterStar unit and should not be connected to anything.

Both the DMR-200 and the MeterStar electronics are designed to accept 9 VDC to 30VDC. All cables should be less than 30 meters and they should be built with the following guidelines for minimum wire size based on voltage supplied to the DMR-200 terminal.

Input Voltage	Minimum Wire Gauge
8 to 18 VDC	18 AWG
18 to 30 VDC	22 AWG

Cable used for power and data connections to the terminal should be shielded for reliable operation.

The 5 Pin ‘Phoenix’™ connector on the top of the MeterStar board should be connected as follows:

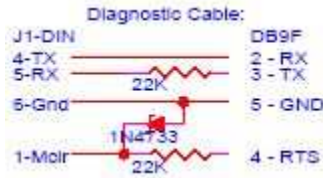
MeterStar 5 - Pin Phoenix (J2)	DMR-200 Conxall	Description
1	5	+12 Volt Power
2	4	Ground
3	3	TX Data
4	2	RX Data
5		Not used

Testing the Installation

After completing the mounting and wiring of the MeterStar installation you should connect to the unit with a lap-top computer or other suitable terminal. The round DIN connector located towards the center of the MeterStar board is used for both programming and monitoring of the MeterStar operation. A cable containing the necessary interface electronics must be used to provide the connection. This cable is available from Crystalline Technology, Inc. (Part # CFSB09) and has the round DIN

connector on one end and a DB-9 F connector on the other suitable for connection to a standard lap-top computer. You may also make your own cable if desired.

Figure 2 (diagnostic cable)



You are now ready to perform the final steps of the installation. Using HyperTerminal or some other suitable terminal emulation program select the following settings:

Baud Rate:	19200
Data Bits:	8
Stop Bits:	2
Parity:	None
Handshake:	None

When you initially connect to the MeterStar board you will see a message similar to the one below:

```
(C)2004 Crystalline Technology, Inc.  
13-Jan-05 15:42:36  
Fisher RTU  
>
```

At this point, enter the pass code '55' to get a command prompt. If nothing is entered for approximately 1 minute the unit times out and resumes normal operation. If you do not see the '>' prompt, perform a reset of the MeterStar board. If you are using HyperTerminal you do this by selecting the 'CALL' tab on the tool bar then select 'Disconnect' followed by 'Call' again. This effectively drops the RTS line on the RS-232 port and re-applies RTS. Since this is connected to the MeterStar board (through a protective zener diode) it causes a reset. If the unit happens to be in the sleep mode you may need to do this twice, once to wake it up, once to reset the device.

Once you enter the pass code you will see the '?' Prompt:

```
>55  
?
```

Depending on the features enabled for your particular configuration the following commands are available.

NOTE:

The simple terminal monitor provided on the MeterStar board is for diagnostic and testing purposes by experienced personnel only. There is NO user protection against invalid commands or parameters. If you make a mistake you cannot backspace and correct the problem. You should stop immediately and perform the reset as described above. A bad command or parameter could result in a non-functional device requiring reprogramming.

See the appropriate section in the appendix for commands and parameters that works with your specific configuration of MeterStar.

The monitor operates with a series of single letter commands. The command entered is not echoed to the local terminal. Thus, when you enter a command such as 'R' followed by a two digit hexadecimal address to read a memory location you see something similar to what is shown below when the commands 'R03' and 'R04' are entered:

```
?03=03  
?04=18  
?_
```

To test the signal from the satellite you can enter the command 'S' to get a display of the Signal to Noise Ration commonly referred to as SNR. For most installations, it is possible to get a SNR ratio greater than 20 dB even as far north as the Artic Circle when the unit is properly mounted with an unobstructed view of the sky where the satellite is located. A sample display of a good SNR is shown below:

```
?SNR:  
Good 23 dB  
Poor 0 dB  
Poor 1 dB  
Poor 6 dB  
Poor 13 dB  
Good 16 dB  
Good 18 dB  
Good 19 dB  
Good 21 dB  
Good 21 dB  
Good 22 dB  
Good 22 dB  
Good 22 dB  
Good 22 dB  
Good 22 dB  
Good 23 dB  
Good 23 dB  
Good 23 dB
```

It is normal to see the SNR revert to 0 and then slowly increment to a final number. This occurs as the DMR locks onto the satellite signal and is a good indication of proper operation. To end the running display, simply press the space bar.

When testing the interface between the MeterStar and the EGM it is sometimes useful to force the MeterStar to poll the EGM. This can be done with the 'I' command. Different devices will provide a different display depending on the data that is read from the EGM and processed by the MeterStar. A typical display resembles the following:

```
?dP=50  
P=250  
T=60  
V=12494  
dP=50  
P=250  
T=60  
V=614  
?
```

dP represents differential pressure, P line pressure, T temperature, V volume or flow rate. Only the whole number is shown in this display. If no response is received you will typically see a 'WDT' that indicates the MeterStar timed out, reset, and proceeds to operate in a normal fashion. Repetitive WDT messages indicate that something is wrong and that MeterStar is unable to proceed. It is suggested that you review your wiring and assure that the EGM is configured for the proper baud rate and address.

A typical sequence for MeterStar appears below:

Sat OK	<- Indication that the DMR has acquired the satellite
14:42 8	<- Current Hour and Minute (HH:MM) of EGM and Contract Hour
dP=50	<- Current differential pressure
P=250	<- Current line pressure
T=60	<- Current gas temperature
V=12494	<- Current flow rate
dP=50	<- Yesterday average differential pressure
P=250	<- Yesterday average line pressure
T=60	<- Yesterday average gas temperature
V=614	<- Yesterday volume
Send+	<- Message queued for transmission
Sent	<- Successful transmission
Slp	<- Sleep to conserve power
Sat OK	<- Sequence repeats
14:45 8	
dP=50	
P=250	
T=60	
V=12494	
Slp	

Appendix A

Standard Fisher™ EGM Configuration:

The Fisher 103, 407, and 503™ are supported with MeterStar™. Fisher is sold under the Fisher/Rosemont and Emerson Process™ brand names and is available through an extensive distribution network.

Upon reset the MeterStar will display the following banner:

```
(C)2004 Crystalline Technology, Inc.  
13-Jan-05 15:42:36  
Fisher RTU  
>_
```

Features:

- Daily Report 10 minutes after contract hour
- On Demand Snap Shots available
- Gas Quality (BTU, SG, CO2, N2)
- Pipe Size
- Orifice Size

The following “default” configuration of the Fisher is used:

For applications where MeterStar is connected to a separate communications port on the Fisher the following is used:

Baud Rate:	9600
Group Address	2
Unit Address	1
Data Bits	8
Parity	None
Stop Bits	2
User Name	LOI
Pass Code	1000

If the unit is using an LOI switch then MeterStar should be configured to work with the default group address and user address show below:

Group Address	240
Unit Address	240

To change the group and unit address in MeterStar you must convert them to a hexadecimal number (base 16) by inputting the following commands: Enter the unit

address at memory location 03 and the group address at memory location 04. As an example, to change the unit to group 240, unit 240 you would enter:

W03F0

W04F0

As shown in the following example:

?03f0

03=f0

?04f0

04=f0

?_

Commands supported in the Fisher RTU application:

Supported Commands:

Command	Parameter	Description
M	6 digit register and data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the Fisher for new data
W	4 digit address and data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite
V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register and data	Protected command available only for factory use

The following data is obtained from the Fisher EGM:

Point	Description	Range
12,0,2	Current Hour	0 to 23
12,0,1	Current Minute	0 to 59
15,0,10	Contract Hour	0 to 23
10,0,0	Current Differential Pressure	0 to 511.96875
10,0,1	Current Line Pressure	0 to 32767.75
10,0,2	Current Gas Temperature	+/- 0 to 255.5
10,0,3	Current Flow Rate	IEEE 754 Floating Point
19,1,5	Previous days average Differential P	0 to 511.96875
19,2,5	Previous days average Line Pressure	0 to 32767.75
19,3,5	Previous days average Temperature	+/- 0 to 255.5
10,0,7	Previous days total volume	IEEE 754 Floating Point
7,0,9	Pipe Diameter	IEEE 754 Floating Point
7,0,10	Orifice Diameter	IEEE 754 Floating Point
7,0,5	Specific Gravity	IEEE 754 Floating Point
7,0,6	BTU	IEEE 754 Floating Point
7,0,23	N2	IEEE 754 Floating Point
7,0,24	CO2	IEEE 754 Floating Point

Dynamic Fluid Computer™

MeterStar supports the Dynamic Fluid Computer E-Chart™ EGM using the standard MODBUS RTU protocol. Upon reset, the MeterStar displays the following banner:

Features:

- Daily Reports 10 minutes after contract hour
- On Demand Snap Shot available
- Gas Quality
- Pipe Size
- Orifice Diameter

```
(C)2004 Crystalline Technology, Inc.  
14-Jan-05 10:06:22  
Dynamic Flow E-Chart  
>_
```

The standard default parameters should be maintained in the E-Chart:

Baud Rate	9600 Baud
Data Bits	8
Stop Bits	2
Parity	None
Modbus Address	1

The modbus address that is used by the E-Chart can be changed in the MeterStar by changing user parameter location 17.

Commands supported in the E-Chart RTU application:

Command	Parameter	Description
M	6 digit register and data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the E-Chart for new data
W	4 digit address and data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite
V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register and data	Protected command available only for factory use

The following modbus registers are polled by MeterStar:

Address	Description	Range
3035	Current Hour	0 to 23
3036	Current Minute	0 to 59
2583	Contract Hour	0 to 23
7113	Current Differential Pressure	0 to 511.96875
7115	Current Line Pressure	0 to 32767.75
7114	Current Gas Temperature	+/- 0 to 255.5
7102	Current Flow Rate	IEEE 754 Floating Point
	Previous days average Differential Pressure	
7259		0 to 511.96875
7261	Previous days average Line Pressure	0 to 32767.75
7260	Previous days average Temperature	+/- 0 to 255.5
7277	Previous days total volume	IEEE 754 Floating Point
9081	Pipe Diameter	IEEE 754 Floating Point
9083	Orifice Diameter	IEEE 754 Floating Point
7115	Specific Gravity	IEEE 754 Floating Point
7117	BTU	IEEE 754 Floating Point
7124	N2	IEEE 754 Floating Point
7125	CO2	IEEE 754 Floating Point

On the web at <http://www.MeterStar.com> the unit should be configured as type 'METERSTAR'.

FlowStar™

MeterStar supports the FlowStar DCR-900™ EGM using the standard MODBUS RTU protocol. FlowStar is a Canadian manufacturer of high quality measurement equipment utilizing a precision turbine as the primary element. You can obtain more information about this device by visiting them on the web at <http://www.FlowStar.ca> .

Features:

- Daily Reports
- Optional Casing Pressure
- Low Power sleep mode

Upon reset the MeterStar will display the following banner:

```
>(C)2004 Crystalline Technology, Inc.  
14-Jan-05 10:51:38  
Flowstar RTU  
>
```

Since the DCR-900 is a RS-485 device, it is necessary to install a RS-485 to RS-232 converter between the MeterStar and the DCR-900. Contact FlowStar for a suitable device such as the Raven that maintains area classification.

Baud Rate	9600 Baud
Data Bits	8
Stop Bits	2
Parity	None
Modbus Address	1

The modbus address that is used by the DCR-900 can be changed in the MeterStar by changing user parameter location 17.

Commands supported in the FlowStar RTU application:

Command	Parameter	Description
M	6 digit register and data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the EGM for new data
W	4 digit address and data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite

V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register and data	Protected command available only for factory use

Registers used by MeterStar to support the FlowStar are:

Address	# of Regs	Description
105	1	Current Differential Pressure
109	2	Current Line Pressure
111	2	Current Gas Temperature
158	2	Previous days average Line Pressure
160	2	Previous days average Temperature
156	2	Previous days total volume
102	1	Pressure Units
103	1	Pressure Mode
110	2	Channel 1 Pressure
112	2	Channel 1 Temperature
107	1	AGA Volume Units
118	2	Channel 3 External RTD Temperature
114	2	Casing Pressure
124	2	Current Flow Rate

On the web at <http://www.MeterStar.com> the unit should be configured as type 'FLOWSTAR'.

RemoteIO

The RemoteIO configuration does not require an EGM be present. It is designed to support the 5 I/O points on the MeterStar board. Many of the EGM versions of the program also supports the 5 I/O points on the MeterStar board. Please contact your distributor if you have any questions concerning the RemoteIO capabilities on your unit.

MeterStar is equipped with a 10 bit Analog to Digital converter that can be programmed to use internal voltage references for the lower and upper limit, or by special request we can use external references.

To configure the I/O points you must program the user parameter at location A1 to reflect the desired I/O points that will be used. Each I/O point can be enabled or disabled and set either Analog Input or Digital Input.

To determine the desired configuration, add up the values below. Convert the resulting total to hexadecimal (base 16) and enter that number as parameter A1 using the command "WA1xx" where xx is the hexadecimal number calculated above.

01	Analog 1 enabled
02	Analog 1 defined for analog input
04	Analog 2 enabled
08	Analog 2 defined for analog input
16	Analog 3 enabled
32	Analog 3 defined for analog input
64	Analog 4 enabled
128	Analog 4 defined for analog input

To enable Analog 5 you must set user parameter A0:

01	Analog 5 enabled
02	Analog 5 defined as analog input

When an input is configured as a digital input the circuit is considered normal when the input is connected to ground. Anything greater than 2.5 V DC will be considered a failed condition. A special alarm is enabled if AI4 or AI5 is configured as a digital input. Any transition of the digital input initiates an Alarm message and cause resulting notification of the user if configured to do so on the host system. In addition, if AI5 is not otherwise enabled for input (user parameter A0 set to 00 with the command WA000), then AI5 can be used as a current source and is raised to 5 VDC prior to checking any input. The current draw on AI5 should be limited to less than 20mA.

A typical application is a compressor alarm. Use an oil pressure, or water pressure switch connected to AI4 with a 1,000 Ohm resistor from AI4 to AI5. The other side of the

switch should be connected to ground and the switch should be normally closed when the compressor is running. Enter the commands WA000 and WA140 to enable the alarm input on AI4 and to use AI5 as a current source.

Hexadecimal Conversion

You may use the following table to convert a number from decimal (base 10) to hexadecimal (base 16). Locate the number to be converted in the table and get the first most significant digit from the column on the left. The second, least significant digit can be found in the bold row along the top.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
3	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
4	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
5	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
6	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
7	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
8	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
9	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
A	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
B	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
C	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
D	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
E	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
F	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Each of the AIO pins on the MeterStar interface is protected with a transient surge suppression device that restricts input voltages to 5 volts DC or less. There is a 100 ohm resistor in series with the input to reduce current. Care should be used to assure that the maximum voltage on the input pin is not exceeded.

A 250 ohm resistor can be installed from ground to an AIO input pin and placed in series with a traditional 4 to 20mA sensor. Since one side of the circuit is connected to ground, a current loop isolator may be required if other devices exist on the same current loop or if the current loop is not capable of being grounded.

Special configurations can be programmed by Crystalline Technology for special applications where only 3 AI points are used and a different range such as 1 to 5 VDC is required. With the flexibility of the MeterStar interface, other applications are available where algorithms can be applied to the I/O points and action taken or transmissions made as a result.

Bristol Babcock

Bristol Babcock 33xx™ and ControlWave™ devices are supported using the native BSAP protocol. Upon reset of the MeterStar board you will be presented with the following banner when connected to the diagnostic port:

Features:

- Daily Data
- On Demand Snap Shots
- Tubing or Casing Pressure available
- Custom signal names available on request

```
(C)2004 Crystalline Technology, Inc.
14-Jan-05 11:54:00
Bristol RTU
>
```

```
Baud Rate      9600 Baud
Data Bits      8
Stop Bits      2
Parity         None
```

Due to the flexibility of the Bristol line of RTU and since so many program them with their own signal names, you should contact the factory for specific applications using the Bristol Babcock EGM. Typical applications would use signal names such as those shown in the default setup.

Name	Description	Range
DIFFPRES.DAY.	Previous Day Differential Pressure	0 to 511.96875
STATPRES.DAY.	Previous Day Static Pressure	0 to 32767.75
FTEMP.DAY.	Previous Day Gas Temperature	+/- 0 to 255.5
VOLYDY.YESDAY.CALC	Gas Volume Yesterday	IEEE 754
#TIME.005.	Current Hour	0 to 23
#TIME.006.	Current Minute	0 to 59
CONTRACT.HOUR.CFG	Contract Hour	0 to 23
DIFFPRES..	Current Differential Pressure	0 to 511.96875
STATPRES..	Current Line Pressure	0 to 32767.75
FTEMP..	Current flowing temperature	+/- 0 to 255.5
FLOWRATE..CALC	Current Flow Rate	IEEE 754
CTP..	Current Tubing Pressure	
ORIF.DIAM.CFG	Orifice Plate Size	IEEE 754

Commands supported in the FlowStar RTU application:

Command	Parameter	Description
M	6 digit register and data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the EGM for new data
W	4 digit address and data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite
V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register and data	Protected command available only for factory use

Control Microsystems

Control Microsystems manufactures a complete line EGM and RTU products that support “RealFlow”™ for gas and liquid measurement applications. MeterStar supports the default configuration of RealFlow for single run gas measurement. Two different versions of MeterStar are available depending on customer demands. The typical once per day report of daily volumes and average pressures and temperatures is supported as a standard MeterStar device. In this configuration, the user may request current flowing conditions via a poll for data. Pipe and Orifice plate size are sent when ever a change is detected.

For more demanding applications, we offer a version that sends information hourly with hourly averages. This version is offered to address more complete audit trail detail as required by certain regulatory agencies. Please contact your dealer for satellite air time pricing information on hourly reporting.

Features:

- Daily Report 10 minutes after contract hour
- Pipe and Orifice Size
- Demand Polling
- AI Support available
- Hourly Data or On Demand Snap Shots
- Remote configuration of Orifice Size
- Metric or US

The 4202 GFC combined with MeterStar provides a very powerful and cost effective solution. The following default parameters are used in the MeterStar program:

Baud Rate	9600
Word Size	8 Bits
Stop Bits	2
Parity	None
Protocol	Modbus RTU
Address	1

When reset, the MeterStar provides a banner resembling the following:

```
(C)2004 Crystalline Technology, Inc.  
14-Jan-05 13:47:29  
CMI 4202GFC  
>_
```

If the hourly reports are enabled the banner will include that as well:

```
(C)2004 Crystalline Technology, Inc.  
14-Jan-05 13:57:44  
CMI 4202GFC (Hourly)  
>_
```

Two different units are supported with MeterStar. The US5 includes data reported in degrees Fahrenheit, inches of water, PSI, and MCF and is the default. Alternatively you may use Metric1 for data reported in Degrees Centigrade, pressures in kPa, and volumes in E3M3 (10³M³). If Metric1 is selected you should enter the command “Z57037201” so the data will be processed correctly when displayed on the web.

Commands supported in RealFlow RTU application:

Command	Parameter	Description
M	6 digit register / data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the EGM for new data
W	4 digit address / data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite
T		Displays EGM Time and contract hour
V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register / data	Protected command available only for factory use

Modbus registers implemented to support the RealFlow program are as shown below:

Register	Description	Range
48722	Last hour average DP	0 to 511.96875
48720	Last Hour average line Pressure	0 to 32767.75
48718	Last Hour average temperature	+/- 0 to 255.5
48718	Last Hour Volume	IEEE 754
47526	Current Differential Pressure	0 to 511.96875
47524	Current Line Pressure	0 to 32767.75
47522	Current gas temperature	+/- 0 to 255.5
47528	Current Gas Flow Rate	IEEE 754
47578	Yesterday average dP	0 to 511.96875
47576	Yesterday average line pressure	0 to 32767.75
47574	Yesterday average gas temp	+/- 0 to 255.5
47566	Yesterday volume	IEEE 754
49687	Pipe Size	IEEE 754
49682	Orifice Size	IEEE 754
48506	Current Hour	0-23
48507	Current Minute	0-59
49642	Contract Hour	0-23

Standard applications should be configured at <http://www.MeterStar.com> as “METERSTAR” while those with hourly data should be configured as “REALFLOW”.

GlobalFlow Fisher

The GlobalFlow Fisher implementation expands upon the standard Fisher by adding Casing Pressure to the basic packet transmitted during the daily report and the on demand snap shot. In order to squeeze the casing pressure into the packet, the range and precision of the differential pressure and the line pressure were slightly reduced. This application is supported by GlobalFlow Inc. a Canadian company located in Medicine Hat, Alberta, Canada (<http://www.GlobalFlow.ca>). Please contact them for additional detail concerning this load.

This program only works with the Fisher 103 due to the different addressing of the auxiliary I/O used to support the Casing Pressure.

Features:

- Daily Report 10 minutes after contract hour
- Casing Pressure
- Orifice Size
- Demand Polling
- Support for RemoteIO AI1 to AI5

Upon reset units configured as the GlobalFlow Fisher will present the following banner:

```
(C)2005 Crystalline Technology, Inc.  
03-Feb-05 18:57:02  
GLF Fisher RTU  
AI Enabled  
>_
```

The communications between the MeterStar board and the Fisher 103™ is done on the standard LOI communications channel and the default configuration must be maintained:

Baud Rate:	9600
Word Length	8
Stop Bits	1
Parity	None
Group Address:	240
Unit Address:	240

Data obtained from the Fisher 103 for the standard GlobalFlow Fisher application:

User Point	Description	Range
10,0,0	Current dP	0 to 511.96875
10,0,1	Current Line Pressure	0 to 511.75
10,0,2	Current Temperature	+/- 0 to 255.5
10,0,3	Current Flow Rate	IEEE 754 FP
3,16,14	Casing Pressure	0 to 511.75
7,0,10	Orifice Plate	IEEE 754 FP
19,1,5	Previous Day dP	0 to 511.96875
19,2,5	Previous Day Line Pressure	0 to 511.75
19,3,5	Previous Day Temperature	+/- 0 to 255.5
10,0,7	Previous Day Volume	IEEE 754 FP

This application should be configured as load file 'GLOBALFLOW' in the www.MeterStar.com host system for proper operation.

See the section "RemoteIO" for configuration of AI1 to AI5 ports.

GlobalFlow Fisher™ Optimizer

GlobalFlow Inc. developed some proven optimizer techniques that utilize the Fisher 103 and 407 units to implement their algorithms. Specific questions concerning the optimization techniques and their application should be directed to GlobalFlow (<http://www.GlobalFlow.ca>). MeterStar supports this application as follows:

Features:

- Dual Flow Rates (Flow on Casing and Tubing)
- Dual Pressures
- Dual Orifice Plate sizes
- Flow Time on Casing and Tubing
- Remote reading and writing of Soft Point 3 parameters
- Daily Reports 10 minutes after contract hour
- On Demand snap shots
- Automatic reporting of Soft Points when changed

Fisher Configuration:

Baud Rate	9600
Word Size	8 bits
Stop Bits	2
Parity	None
Group Address	240
Unit Address	240

Data obtained from the Fisher EGM includes the following:

User	Point	Description	Range
	10,0,1	Casing Pressure	0 to 4095
	10,0,3	Casing Flow Rate	0 to 16383.25
	10,1,1	Tubing Pressure	0 to 4095
	10,1,3	Tubing Flow Rate	0 to 16383.25
	42,0,6	Casing Flow Minutes / 2	0 to 1023
	42,1,6	Tubing Flow Minutes / 2	0 to 1023
	7,0,10	Casing Orifice Size	IEEE 754 FP
	7,1,10	Tubing Orifice Size	IEEE 754 FP
	19,2,5	Average Casing Pressure	0 to 4095
	10,0,7	Casing Volume	0 to 16383.25
	19,9,5	Average Tubing Pressure	0 to 4095
	10,1,7	Tubing Volume	0 to 16383.25
	17,2,2	SoftPoint 3, Parm 1	0 to 4095
	17,2,3	SoftPoint 3, Parm 2	0 to 4095

17,2,4	SoftPoint 3, Parm 3	0 to 4095
17,2,5	SoftPoint 3, Parm 4	0 to 4095
17,2,6	SoftPoint 3, Parm 5	0 to 4095
17,2,7	SoftPoint 3, Parm 6	0 to 4095
17,2,8	SoftPoint 3, Parm 7	0 to 4095
17,2,9	SoftPoint 3, Parm 8	0 to 4095
17,2,10	SoftPoint 3, Parm 9	0 to 4095
17,2,11	SoftPoint 3, Parm 10	0 to 4095
17,2,12	SoftPoint 3, Parm 11	0 to 4095
17,2,13	SoftPoint 3, Parm 12	0 to 4095
17,2,14	SoftPoint 3, Parm 13	0 to 4095
17,2,15	SoftPoint 3, Parm 14	0 to 4095
17,2,16	SoftPoint 3, Parm 15	0 to 4095
17,2,17	SoftPoint 3, Parm 16	0 to 4095
17,2,18	SoftPoint 3, Parm 17	0 to 4095
17,2,19	SoftPoint 3, Parm 18	0 to 4095
17,2,20	SoftPoint 3, Parm 19	0 to 4095
17,2,21	SoftPoint 3, Parm 20	0 to 4095
16,0,24	FST Stop / Run	0 / 1
13,0,16	Warm Start	0 / 1

Special support is provided on the web page to allow reading and writing of the Soft Point parameters in support of GlobalFlow Inc. proprietary production optimization.

DynaCorp

The DynaCorp version of the program is designed specifically to address the requirements of Well-Testing. Specifically, DynaCorp of Calgary Canada manufactures mobile well testing trucks which have on board complete separation, mud retrieval, and gas measurement intended to be used immediately after drilling or re-working a well. This application is supported by GlobalFlow, Inc, our Canadian distributor.

Features:

- SnapShots are programmable interval via satellite
- dP, P, T, Flow Rate, Casing, Tubing, Hydrocarbons, Water
- Reporting done in two packets
- Daily Reports with average dP, P, T, and Volume
- Support for Analog I/O Functions
- Support Fisher 103 with 6 point I/O board
- Metric or US Empirical units
- Standard MeterStar format

Fisher Configuration:

Baud Rate	9600
Word Size	8 bits
Stop Bits	2
Parity	None
Group Address	240
Unit Address	240

Data Obtained from the Fisher 103 (must have 6 point I/O board installed)

User		
Point	Description	Range
10,0,0	Current dP	0 to 511.96875
10,0,1	Current Line Pressure	0 to 32767.75
10,0,2	Current Temperature	+/- 0 to 255.5
10,0,3	Current Flow Rate	IEEE 754 FP
3,66,14	Casing Pressure	0 to 32767
3,65,14	Tubing Pressure	0 to 32767
5,21,19	Hydrocarbon Total	0 to 2,097,151
5,22,19	Water Total	0 to 2,097,151
7,0,9	Pipe Diameter	IEEE 754 FP
7,0,10	Orifice Plate	IEEE 754 FP
19,1,5	Previous Day dP	0 to 511.96875
19,2,5	Previous Day Line Pressure	0 to 32767.75
19,3,5	Previous Day Temperature	+/- 0 to 255.5
10,0,7	Previous Day Volume	IEEE 754 FP

ABB TotalFlow™ Model 6610

Supported is the ABB TotalFlow 6610 using the TotalFlow ASCII protocol and the newer series of TotalFlow units supporting the Modbus protocol. The original 6610 defined a limited set of commands that were executed in an ASCII data stream. MeterStar issues these ASCII commands and parses and formats the response for transmission on the satellite. Due to the limited data available on the 6610 not all features normally available to MeterStar are available.

Commands supported for the TotalFlow ASCII mode (4800 baud, even parity, 7 data bits, 1 stop bit):

- dP
- aP
- T
- Vm
- Vy
- Va

This version of MeterStar is somewhat limited due to the limited amount of data accessible from the TotalFlow. New meter installations should use the later versions of the Total Flow such as the XFC 6413 which supports the Modbus Protocol.

ABB TotalFlow™ Model XFC 6413

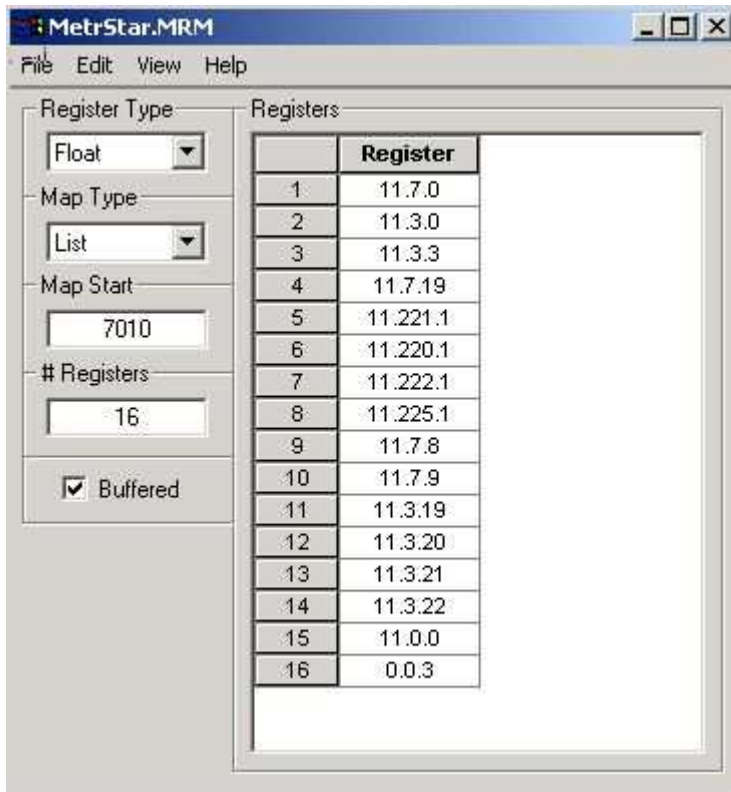
MeterStar fully supports the Model XFC 6413™ when properly configured for modbus.

Features:

- SnapShots have a programmable interval via satellite
- dP, P, T, Flow Rate
- Yesterday average dP, P, T, and daily volume
- BTU, SG, N2, CO2 Gas Quality updated on change
- Pipe and Orifice Size updated on change
- Support for Analog I/O Functions
- Metric or US Empirical units
- Standard MeterStar format

To configure the flow computer you should use the PCCU32 software available from ABB and setup a com port such as com port 2 for Modbus communications, 8 data bits, no parity, 2 stop bits, modbus RTU slave protocol, and address 1, with the register format set to “32 bit TotalFlow”.

You can then use the Modbus Register Editor to create the following Modbus registers:



After configuring the Modbus registers the file must be uploaded to the 6413 and attached to the com port being used with the MeterStar unit.

The data polled from the 6413 includes the following Information:

Register	Description	Range
7010	Current Differential Pressure	0 to 511.96875
7011	Current Line Pressure	0 to 32767.75
7012	Current Temperature	+/- 0 to 255.5
7013	Current Flow Rate	IEEE 754
7014	Yesterday average dP	0 to 511.96875
7015	Yesterday average line pressure	0 to 32767.75
7016	Yesterday average gas temp	+/- 0 to 255.5
7017	Yesterday volume	IEEE 754
7019	Pipe Size	IEEE 754
7018	Orifice Size	IEEE 754
7020	BTU	IEEE 754
7021	Specific Gravity	IEEE 754
7022	N2	IEEE 754
7023	CO2	IEEE 754

Commands supported in the TotalFlow XFC 6413 FCU application:

Supported Commands:

Command	Parameter	Description
M	6 digit register and data	Writes to IAM registers (Reserved for diagnostic use)
N	2 digit register	Read the IAM registers (Reserved for diagnostic use)
C		Clears the First Time Flag
F		Sets the First Time Flag (causes transmission of daily data)
I		Poll the Fisher for new data
W	4 digit address and data	Writes to user parameter memory
R	2 digit address	Reads the user parameter memory
Q		Quits monitor and returns to normal operation
S		Displays the SNR from the satellite
V		Displays the program version and compile date
X	4 digit address	Displays memory
Z	6 digit register and data	Protected command available only for factory use

APPENDIX B – DMR Scripts

The DMR has two different unique identifiers associated with it. The first is referred to as an ID and always starts off with a DCC00 number and contains 12 digits. Once the unit is activated on the INMARSAT network it is given a unique control number. The control number can be likened to a phone number on a cellular phone. It is this unique control number that identifies where the data came from. It is critical that if the DMR is moved from one location to another that your distributor be notified so the data is not orphaned.

In addition to the MeterStar programs, the DMR-200 has the ability to execute a simple script. The scrip controls such things as power consumption, satellite availability, alarms, timers, and simple actions. Ordinarily the DMR is shipped with a script suiting customer requirements. From time to time it may become necessary to update or otherwise make changes to this script. These changes can be made by either a local user with special programs and cables or remotely over the Satellite by Crystalline Technology.

Standard Scripts

The standard script provided by Crystalline Technology, Inc. for the MeterStar applications supports a low power operational mode and depends on the MeterStar processor to initiate all transmissions. The script also defines the custom polls required by the MeterStar system to support such features as AGA configuration along with several special control functions.

Specific features of the Standard “MeterStar.txt” script for the DMR include the following features:

- Morning Report with a snap shot of current flowing conditions taken at 4:00 AM typically.
- Daily reports at contract hour containing dP, P, T, and Volume typically.
- Pipe and Orifice size reporting when changes are detected.
- Specific Gravity, Nitrogen, CO2, and N2 reporting when changes are detected.
- Support for the RemoteI/O capability including the 5 configurable Analog / Digital inputs and outputs. Typical applications include compressor, tank, chemical injection, environmental sensors and almost anything else that supports a digital or analog output.
- GLFextras which include water and oil turbines, casing and tubing pressures.
- GLFoptimizer with complete support of reading and writing the soft point 3 registers typically used in many FST programs.
- OffShore with support for a second metering run for reporting of oil production and associated configuration information.
- Ability to poll daily reports, snapshots, and configuration information.
- Ability to write new orifice size to remote EFM.

- Ability to establish an periodic automatic snap shot at intervals from 5 minutes to 24 hours.

Custom Scripts

Many customers and or specific applications require a custom script. This allows for many enhanced functions such as:

- Automatic Morning Snap Shots at a predetermined time
- Custom Alarming for RemoteIO applications
- Special power saving modes
- GPS Support
- Monitoring and / or control of new devices

You are invited to contact us for more information.

APPENDIX C – Other Applications

MSFBXlator – A Modbus to EGM Protocol translator

NOTICE:

The MSFBXlator now supports the new models of the ABB Totalflow. Since the ABB protocol on these units is full duplex we changed the interface between the gas flow computer and the Ferguson Beauregard MODBUS host. The EFM slave is now connected to the 5 pin connector labeled “DMR” and the MODBUS master is connected to “Ext RTU”.

The MSFBXlator is a special program for the MeterStar board that provides protocol translation between a MODBUS host and an EFM slave. Designed specifically to support the Ferguson Beauregard line of controllers, the MSFBXlator will respond to a MODBUS request by polling the desired gas flow computer for data and translating the response back to MODBUS. Currently supported are the Bristol Babcock 33xx and 3530 using the BSAP protocol, Emerson / Fisher 103, 407, and 503 with the ROC protocol, and the ABB Totalflow 6610, uFlo, and Xfc series using the ABB protocol.

The MODBUS registers polled determines the protocol used to communicate with the gas flow computer. There are two different security models used with the ROC protocol and the MSFBXlator will try one then the other before it can respond to the MODBUS request. This may lead to an error on the first poll of a Fisher unit until the MSFBXlator determines the actual model of Fisher that it is connected to.

The ABB Totalflow is even more complex. The original 6610 uses a half duplex 2400 baud format where the later versions can also operate at 9600 baud and use a full duplex format. Again, the MODBUS host may get a couple of timeouts before the MSFBXlator is able to determine the type of Totalflow that it is communicating with.

The Modbus Host is connected to the 4 pin phoenix connector labeled “Ext RTU” on the right side of the MeterStar board (see figure 1). The host should be configured for MODBUS at 9600 baud, 8 data bits, no parity and use the RTU mode of the MODBUS protocol. Ground, TX, and RX at RS-232 levels are required on pin 2 (ground), pin 3 (TX), and pin 4 (RX).

The Gas Flow Computer – GFC (also referred to as Electronic Flow Measurement – EFM) unit is connected to the 5 pin connector located on the top right side of the board labeled “DMR” (see figure 1). Ground is on Pin 2, TX on pin 3 and RX on pin 4. The Fisher and Bristol Babcock EFM units support a “wake-up” signal which is available on Pin 1 of the 4 pin connector labeled “Ext RTU”.

The MODBUS master may poll certain registers of the MSFBXlator using any valid slave address. The FBXlator will parse the MODBUS message and if it meets certain

criteria (function 3 and one of the valid MODBUS registers listed below), the FBXlator will attempt to communicate with an EFM using the EFM's native protocol and default baud rate.

A diagnostic port is provided on the round DIN connector and may be connected to a lap top computer through a special cable provided by Crystalline Technology. The lap top should be configured for 19,200 baud, 8 data bits, and no handshake using the standard HyperTerminal program provided with all Windows™ computers.

Operation:

Normal operation simply requires that the unit be connected to the MODBUS host and a supported EFM. Defaults were chosen for all parameters to make this as easy as possible for most applications. In certain applications it may be necessary to change some of the parameters used to communicate with the EFM. For these applications a simple "monitor" mode is provided that can be accessed via a lap top computer.

When power is applied, or a reset condition occurs, the FBXlator program will check to see if a computer is attached to the special console port (DIN connector) and if so, enter the monitor mode. If no activity is detected after a couple of minutes then the FBXlator will automatically exit the monitor mode and resume normal operation.

When the lap top is connected to the MeterStar board you will be presented with a logon screen when power is applied. You can also obtain the same screen by selecting the "disconnect" option from the call tab on HyperTerminal followed by selecting the "call" option to reestablish connection (which effectively performs a reset). The logon screen will resemble the following:

```
(c) 2002-2006 Crystalline Technology, Inc.  
email: support@neartime.com  
MSFBXlator  
>
```

In order to obtain access to the monitor you should enter the password "55" and you will receive a "?" prompt.

There are a limited number of commands that are available in this mode. They include the following: (NOTE, the single letter command is not echoed to the lap-top)

H - Help screen. This will also display the current settings being used. A sample display complete with the "55" logon is shown below:

▶55

?

Version: 24-Mar-06 23:25:24 Serial#: 743

ROC Logon: 'FER' pw: '2808'

ROC Address Group 240, Unit 240

Protocol - Register

BSAP - 7040

TotalFlow - 8001

ROC 103/503 - 7100

ROC 407 - 300

Supported commands (use EXREEME care)

A - Enter ROC group and local address

H - This help

L - Enter ROC Logon and passnumber

F - Test Fisher 407

1 - Test Fisher 503/103

T - Test ABB

B - Test BRISTOL

Q - Quit and run

?

A - Select the mode that is used for group and local addresses for the ROC EFM units. In the automatic mode the group address is determined by the suffix byte appended to the MODBUS message and the unit address will be the same as the MODBUS address used to poll the MeterStar board. You have the option of using fixed addresses that don't depend on the MODBUS message being sent. For most ROC applications the group address of 240 and the unit address of 240 is used on the LOI port.

L - This command allows you to change the logon name and password used for the ROC EGM. By default the logon name is set to "FER" and the password of "2804" is used. You may change this to any other combination including the standard "LOI" and "1000" that is the default for all ROC devices.

F - This will allow you to test the communications and wiring between the MSFBXLator and a Fisher 407 GFC. Upon pressing the "F" key the MSFBXLator will make an attempt to logon to a 407 at 9600 baud using the logon, password, group and local address that has been configured. (See "A" and "L" commands). Upon successful communications you will see a display of the parameters read from the 407.

Data[0] = Differential Pressure

Data[1] = Static Pressure

Data[2] = Temperature

Data[3] = Flow Rate

Data[4] = Total Volume

Data[5] = Previous day volume

```
?ROC 407
Data[0]=0.0
Data[1]=0.0
Data[2]=0.0
Data[3]=0.0
Data[4]=0.0
Data[5]=0.0
?
```

1 - Same as the “F” command but uses security designed for the Fisher 103 or 503 Gas Flow Computers.

T - Communications with the ABB TotalFlow series of GFC’s is considerably different between the original 6610 and the Xfc and uFlo series units. The MSFBXlator starts at 2400 baud and tries to determine the type of unit that is connected. When using the standard interface cable provided by ABB you must hold PIN 4 of the DB9 connector to a positive logic level. The MSFBXlator will provide this signal on pin 1 of the 4 pin connector located on the right side of the board labeled “Ext RTU”.

If the TotalFlow is determined to be an Xfc or uFlo series GFC the MSFBXlator will coordinate changing the baud rate to 9600 baud and begin using the new register assignments required by the TotalFlow.

When you issue the “T” command the MSFBXlator will respond with the model of the TotalFlow that is connected and a list of the data items read from the unit:

```
TF[0] = Differential Pressure
TF[1] = Static Pressure
TF[2] = Temperature
TF[3] = Flow Rate
TF[4] = Total Volume
TF[5] = Previous Day Volume
```

```
?uFlo 62xx
TotalFlow
fb[0]=0.0
fb[1]=12.2
fb[2]=60.0
fb[3]=0.0
fb[4]=0.0
fb[5]=0.0
?_
```

Q - Quit the monitor and enter the normal runtime mode of the FBXlator.

There are timers on the monitor that will cause the FBXLator to exit the monitor and resume normal operation.

In the run time mode, the FBXLator listens for a proper MODBUS message on the DMR port. The FBXLator will attempt to communicate with the EFM depending on the MODBUS registers that are requested. The following table identifies the valid registers and the resulting action that will be taken:

BSAP (MODBUS registers starting at 7040): When a poll for data at registers 7040 is received the FBXLator will set the baud rate to 19200 and poll the EFM using the BSAP protocol. The data requested of the Bristol device is done by signal name and must use the same naming convention (DIFFPRES..., STATPRES..., FTEMP..., FLOWRATE..CALC, VOLYDY.YESDAY.CALC, and VOLTOT.ACCUM.CALC). The data is returned to the host in the same order.

TotalFlow (MODBUS registers starting at 8001): The TotalFlow ASCII protocol by switching the EFM port to 2400 baud, 8 data bits, no parity. The TotalFlow has limited data available through this protocol with the commands dP (differential pressure), aP (line pressure), T (temperature), Vm (current flow rate), Vy (previous day volume), Va (accumulated volume). If the unit is determined to be a uFlo or Xfc series TotalFlow the baud rate is set to 9600 baud and register 11.7.0 is for dP, 11.3.0 for P, 11.3.3 for T, 11.7.19 for Flow Rate, 11.7.23 for previous day volume and 11.7.21 for accumulated volume. Both the TotalFlow and the IEEE formats are supported for floating point numbers.

ROC 103/503 (MODBUS registers starting at 7100): For the Fisher / Emerson ROC devices the baud rate is set to 9600 on the EFM port and the native ROC protocol is supported through function 180. For the ROC 103/503 the TLP registers read are 3,0,14 (dp), 3,1,14 (P), 3,2,14 (T), 47,0,0 (Flow Rate), 47,0,28 (Accumulated), and 47,0,25 (Yesterday Volume). This table of TLP registers to be polled is saved in memory starting at location 07 and can be read and written with the R and W commands. The security defaults to a logon of "FER" and a pass number of "2804" but can be changed to anything else through the monitor as described above. The slave address of the ROC (group and unit) can be determined either through the monitor program or the FBXLator can be configured to use the MODBUS slave address as the unit and the suffix byte passed after the MODBUS message as the group address.

ROC 407 (MODBUS registers starting at 300): The ROC 407 is supported at 9600 baud and uses ROC function 180 to obtain 10,0,0 (dp); 10,0,1 (P); 10,0,2 (T); 10,0,3 (Flow Rate); 42,0,5 (Accumulated volume); and 10,0,7 (Yesterday Volume). This table of TLP registers to be polled is saved in memory starting at location 32 and can be read and written with the R and W commands. The user name and pass number along with the group and unit address can be determined as shown above. It may be desirable to poll the ROC 103 as a ROC 407 to obtain the new TLP register data.