760

EUROTHERM

Serial
Communications
Manual

CONTENTS

1.0 Overview:

This Digital Indicator allows digital communications via an RS-422/RS-485 interface. The RS-422 (5-wire) interface is provided only if the "Retransmission Option" is not present.

The communication protocol available is a limited function set of the JBUS and MODBUS protocols. This allows remote computer "host" data polling and configuration of the Indicator.

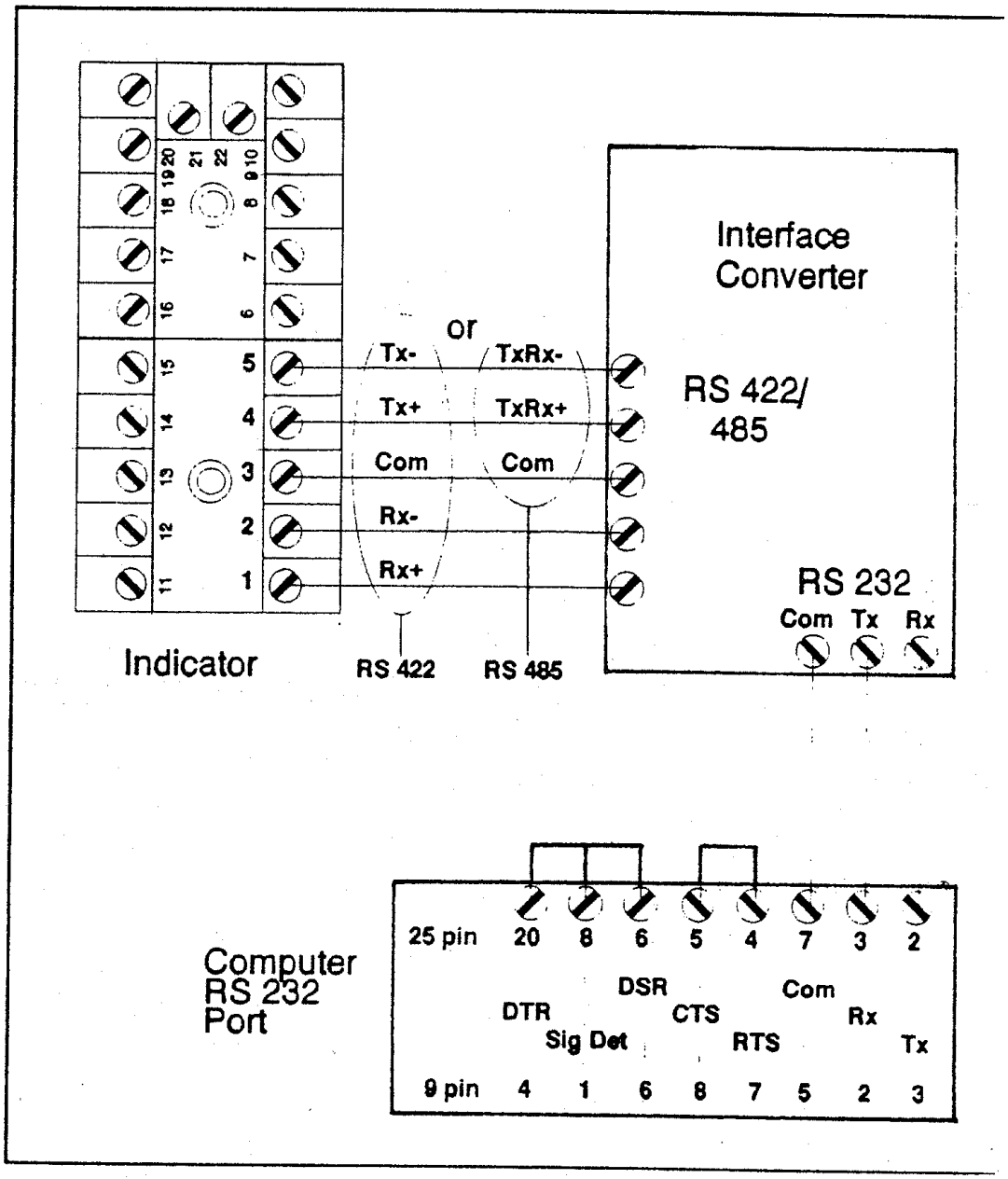
MODBUS is a serial communications protocol defined by Gould Inc. JBUS is a special case of MODBUS defined by APRIL. The two protocols use the same message frame format.

JBUS ® is a registered trademark of APRIL.
MODBUS® is a registered trademark of Gould Inc.

The function codes used by the Indicator are a subset of JBUS and MODBUS function codes (see section 4.0)

2.0 Hardware Interface:

The Indicator communications port is an RS422 or RS485 interface located on the combined Retransmission/Communications card. This card is available with or without 4-20mA signal retransmission. Rear terminals 1 thru 5 are the I/O terminals for the Indicator Retrans/Comms PCB (see figure on following page). If the retransmission option is *not present*, there are 5 terminals available for communications and the RS422 interface is used. If the retransmission option *is present*, there are only 3 terminals available for communications and the RS485 interface is used.



RS422/485 connections:

Terminal #	*3-Wire (485)*	*5-Wire (422)*
1		Rx+ 9
2		Rx-
3	Common	Common
4	TxRx+	Tx+
5	TxRx-	Tx-

3.0 JBUS and MODBUS Protocols:

3.1 Overview:

JBUS and MODBUS define a digital communications network consisting of one "master" (host) and one or more "slave" devices.

Both JBUS and MODBUS offer "ASCII" and "RTU" (Remote Terminal Unit) modes of communication.

The Indicator supports only the RTU (Remote Terminal Unit) mode (not the "ASCII" mode).

Only a limited number of function codes are supported (see sections 3.3.2 and 4.0).

3.2 Mode of Transmission:

JBUS and MODBUS define two modes of transmission "ASCII" and "RTU". The Indicator implements only the "RTU" mode of transmission.

RTU mode specifies a single byte character as:

one start bit,
eight data bits (LSB first),
one parity bit (if even or odd parity),
one (even or odd parity) or two (no parity) stop bits.

3.3 Message Frame Format:

The message format (specified by RTU mode) is the same for a "request" from the "master" as it is for the "response" from the "slave":
Device Address - Function Code - Data - CRC - End of Transmission

3.3.1 Device Address:

Each slave has a unique 8-bit device address (or ID). Gould's MODBUS Protocol defines an address range of 1 to 247 (decimal). The Indicator can be configured with a slave address ranging from 1 to 255.

Device address 0 is a special case for a host broadcast message to all slave devices. In the case of a broadcast the slave will process the command, however, no response shall be sent.

3.3.2 Function Code:

Function codes are single byte instructions, defined by the JBUS and MODBUS protocols, which describe an action for the slave to perform.

The following are the function codes supported by the Indicator : (see section 4.0 for more detail)

Code	*MODBUS Definition*	*Indicator Function*
01	Read Coil Status	Read *n* bits
02	Read Input Status	Read *n* bits
03	Read Holding Registers	Read *n* words
04	Read Input Registers	Read *n* words
05	Force Single Coil	Write a Bit
06	Preset Single Register	Write a word
07	Read Exception Status	Fast Status Read
08	Diagnostics	Loop Back Test
15	Force Multiple Coils	Write *n* bits
16	Preset Multiple Registers	Write *n* words

3.3.2 Parameter Address:

All parameters are accessed using a 16 bit address.

JBUS parameter addresses are equivalent to MODBUS addresses incremented by 1. Conversely, MODBUS parameter addresses are equivalent to JBUS addresses decremented by 1.

The MODBUS parameter address range is 0000h to FFFEh and the JBUS range is 0001h to FFFFh. Reading a parameter address 0000h on a JBUS network will return 0.

The Indicator parameter address range is 0001h to FFFEh, in order to comply with the requirements of both JBUS and MODBUS. Therefore, the Indicator parameter address assignments are the same for both JBUS and MODBUS. These assignments are found in section 5.0.

3.3.3 Cyclic Redundancy Check:

The cyclic redundancy check (CRC), used in RTU mode, is a two byte (16 bit) error check code for the data portion of the message. Only the eight data bits of each character are included in the CRC calculation (not start, stop or parity bits). The CRC is calculated for each byte in the message and then sent (high byte first) as the last two bytes of the message frame.

The CRC is calculated as follows:

1) Load a 16-bit register with FFFFh

2) Exclusive "OR" the first 8-bit byte of the message with the low byte of the register (this is considered the byte on the right).

3) Shift the register one bit to the right (toward the LSB), zero-filling the MSB.

4) If the bit shifted out is *zero* - repeat step 3 (shift again). If the bit shifted out is *one* - exclusive "OR" the register with the polynomial value A001 hex (1010 0000 0000 0001).

5) Repeat steps 3 and 4 until 8 shifts have been performed. When this is done a complete 8-bit byte has been processed.

6) Repeat steps 2 through 5 for the next 8-bit byte of the message. Continue doing this until all bytes have been processed.

7) The final contents of the 16-bit register is the CRC value, however, the byte order is reversed. The LSB of the register is the MSB of the CRC value and is transmitted first.

3.3.4 End of Transmission:

The end of transmission (EOT) for the RTU mode of a JBUS or MODBUS network is a period of inactivity 3 times the single character transmission time. The EOT period following a message transmission indicates to the listening device that the next transmission will be a new message and therefore a device address character.

3.4 Parameter Resolution:

The JBUS and MODBUS protocol limit data to 16 bits per parameter. This provides a maximum resolution of 65,536 counts. This allows **A RANGE OF -32767 (8001h) TO +32767 (7FFFh)** through the communications port. If an instrument parameter is outside this range then the Indicator will reply with -32768 (8000h).

The protocol is also limited to integer only. For the case of floating point values the Indicator uses a conversion factor (multiplier) to retain the desired decimal precision. This multiplier is dependent upon the parameter (see section 5.0 for list). Certain parameters, such as PV, use the configured communications decimal point position (this is independently configurable from the displayed decimal point position).

Other parameters use a fixed precision. For example, if the Indicator measures the PV to be 10.001, and the decimal position is set to 3 places, 10001 will be sent upon a PV request from the host. *The conversion factor for each parameter must be known to both master and slave when the network is initiated* (see section 6.5).

Note: The Indicator can display 5 full digits of resolution Since JBUS/ModBUS limits precision to 16-bit integers (not fully 5 decimal digits) a second configurable decimal point position has been added for communications only. This allows the user to configure communications for optimal resolution without limiting the Indicator's displayed resolution.

4.0 Indicator JBUS/MODBUS Supported Function Codes:

4.1 Function - 01 or 02: Read n bits

Command Message:

Device Address	1 Byte
01 or 02	1 Byte
Address of first bit (MSB)	1 Byte
Address of first bit (LSB)	1 Byte
Number of bits to read (MSB)	1 Byte
Number of bits to read (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The maximum number of bits to read is 16.

Response Message:

Device Address	1 Byte
01 or 02	1 Byte
Number of Bytes of Data	1 Byte
First Byte of Data	1 Byte
...	
...	
Last Byte of Data	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The first data byte contains the status of the first 8 bits. The least significant bit is the first bit. (see section 5.2 for bit addressable parameters)

4.2 Function - 03 or 04: Read n words

Command Message:

Device Address	1 Byte
03 or 04	1 Byte
Address of first word (MSB)	1 Byte
Address of first word (LSB)	1 Byte
Number of words to read (MSB)	1 Byte
Number of words to read (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The maximum number of words to be transmitted is 61.

Response Message:

Device Address	1 Byte
03 or 04	1 Byte
Number of Bytes of Data Read	1 Byte
First Word of Data (MSB)	1 Byte
First Word of Data (LSB)	1 Byte
...	
...	
Last Word of Data (MSB)	1 Byte
Last Word of Data (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

If an instrument parameter is outside the range -32767 to +32767, then the Indicator will reply with -32768 (8000h). (see section 3.4 and section 5.1 - word addressable parameters)

4.3 Function - 05: Write a Bit

Command Message:

Device Address	1 Byte
05	1 Byte
Address of Bit (MSB)	1 Byte
Address of Bit (LSB)	1 Byte
Value of Bit (MSB)	1 Byte
Value of Bit (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

In order to set the addressable bit to 1, the MSB of the Value to write must be FFh. To clear the addressable bit, the MSB of the Value to write must be 00h. All other values are illegal.

The response is identical to the command.

A device address of 0 will broadcast the data to all devices on the network, however, there will be no response, error or otherwise.

Response Message:

Device Address	1 Byte
05	1 Byte
Address of Bit (MSB)	1 Byte
Address of Bit (LSB)	1 Byte
Value of Bit to write (MSB)	1 Byte
Value of Bit to write (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

(see section 5.2 for bit addressable parameters)

4.4 Function - 06: Write a word

Command Message:

Device Address	1 Byte
06	1 Byte
Address of word (MSB)	1 Byte
Address of word (LSB)	1 Byte
Value of word to write (MSB)	1 Byte
Value of word to write (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

Based on internal Indicator software, data values transmitted outside the valid range of a specific parameter, will be automatically clipped by the Indicator to the range limit. Also, certain linearization choices will result in automatic input type choices. There is no MODBUS indication that this has occurred.

A device address of 0 will broadcast data to all devices on the network, however, there will be no response, error or otherwise.

Response Message:

Device Address	1 Byte
06	1 Byte
Address of word (MSB)	1 Byte
Address of word (LSB)	1 Byte
Value of word to write (MSB)	1 Byte
Value of word to write (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

(see section 5.1 for word addressable parameters)

4.5 Function - 07: Fast Read of Status

Command Message:

Device Address	1 Byte
07	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

Response Message:

Device Address	1 Byte
07	1 Byte
Status Byte (see below)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

Fast Status Byte Definition for Read:

(LSB)	Bit 0	-	(1) = Unacknowledged Alarm 1
	Bit 1	-	(1) = Unacknowledged Alarm 2
	Bit 2	-	(1) = Alarm 1 active
	Bit 3	-	(1) = Alarm 2 active
	Bit 4	-	(1) = Digital Input 1 low (or closed)
	Bit 5	-	(1) = PV out of range
	Bit 6	-	(1) = Parameter Changed with Key
(MSB)	Bit 7	-	Not Used

4.6 Function - 08: Loop Back Test

Command Message:

Device Address	1 Byte
08	1 Byte
Subfunction (MSB)	1 Byte
Subfunction (LSB)	1 Byte
Data (MSB)	1 Byte
Data (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The Indicator supports only the "Return Query Data" subfunction (00h). This subfunction instructs the slave to respond with the identical message data as in the command.

The data word sent can be any value and the response will be identical.

Response Message:

Device Address	1 Byte
08	1 Byte
Subfunction (MSB)	1 Byte
Subfunction (LSB)	1 Byte
Data (MSB)	1 Byte
Data (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

4.7 Function - 15: Write n bits

Command Message:

Device Address	1 Byte
15 (0Fh)	1 Byte
Address of first bit (MSB)	1 Byte
Address of first bit (LSB)	1 Byte
Number of bits to write (MSB)	1 Byte
Number of bits to write (LSB)	1 Byte
Number of data bytes	1 Byte
First Byte of Data	1 Byte
...	
...	
Last Byte of Data	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The maximum number of bits to write is 16 which corresponds to 2 bytes of data.

A device address of 0 will broadcast the data to all devices on the network, however, there will be no response, error or otherwise.

Response Message:

Device Address	1 Byte
15 (0Fh)	1 Byte
Address of first bit (MSB)	1 Byte
Address of first bit (LSB)	1 Byte
Number of bits written (MSB)	1 Byte
Number of bits written (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The first data byte contains the status of the first 8 bits. The least significant bit is the first bit. (see section 5.2 for bit addressable parameters)

4.8 Function - 16: Write n words

Command Message:

Device Address	1 Byte
16 (10h)	1 Byte
Address of first word (MSB)	1 Byte
Address of first word (LSB)	1 Byte
Number of words to write (MSB)	1 Byte
Number of words to write (LSB)	1 Byte
Number of data bytes	1 Byte
First Word of Data (MSB)	1 Byte
First Word of Data (LSB)	1 Byte
...	
...	
Last Word of Data (MSB)	1 Byte
Last Word of Data (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The maximum number of words to be transmitted is 59.

Indicator software causes data values outside the valid range of a parameter to be automatically clipped to the range limit. Also, some linearization choices will result in automatic input type choices. There is no MODBUS indication that this has occurred.

A device address of 0 will broadcast data to all devices on the network, however, there will be no response, error or otherwise.

Response Message:

Device Address	1 Byte
16 (10h)	1 Byte
Address of first word (MSB)	1 Byte
Address of first word (LSB)	1 Byte
Number of words written (MSB)	1 Byte
Number of words written (LSB)	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

(see section 5.1 for word addressable parameters)

4.9 Error Responses:

The JBUS and MODBUS protocol define the response to a number of error conditions.

The error response message consists of the device address, the function code with the MSB set ("or"ed with 80h), and an error code specifying the type of error.

Error Response:

Device Address	1 Byte
(Function Code) "or"ed with 80h	1 Byte
Error Response Code	1 Byte
CRC Value (MSB)	1 Byte
CRC Value (LSB)	1 Byte

The Indicator supports the following error responses:

Error Code	*Error*	*Description*
01	Illegal Function	The received function is not supported by the slave.
02	Illegal Data Address	Received data address is not allowable for the slave.
03	Illegal Data Value	The received data value is not allowable for the referenced data address of the slave.
11	Illegal Access	Write of a read-only or read of a write-only parameter.

5.0 Indicator JBUS/MODBUS Parameter Addresses:

5.1 Data Validation

In Indicator software, out-of-range parameters are automatically clipped to their value limits. Parameters such as Linearization Type and Input Source may cause other parameters to modify to suit. MODBUS gives no indication that this has occurred.

5.2 Word Addressable Parameters:

Parameter Address	Parameter	Resolution	Access
0	Not Used	---	---
1	Process Value (PV) (linearized)	Comms Decimal Place	R/O
2	Not Used	---	---
3	Not Used	---	---
4	Status Word (see 5.2.1)	---	R/W*
5	Not Used	---	---
6	Not Used	---	---
7	Not Used	---	---
8	Not Used	---	---
9	Not Used	---	---
10	Not Used	---	---
11	Process Value Low Limit	Same as PV	R/O
12	Process Value High Limit	Same as PV	R/O
13	Alarm 1 Setpoint	Same as PV	R/W
14	Alarm 2 Setpoint	Same as PV	R/W
15	Process Value Low Peak	Same as PV	R/W**
16	Process Value High Peak	Same as PV	R/W**
17	Analog Out. Val. (% range)	0.01	R/O
18	Line Frequency (LinE) 0 = 60 Hz 1 = 50 Hz	1	R/W

* = Not all bits are writable

** = A write of any value will reset parameter

Parameter Address	Parameter	Resolution	Access
19	Linearization (LnriSE)	1	R/W

Note: When writing new linearization, Input Source is automatically changed to reflect the type of linearization (e.g. T.C., RTD, Volts, mV...)

0 = Linear	11 = T.C. Type R
1 = T.C. Type B	12 = T.C. Type S
2 = T.C. Type C	13 = T.C. Type T
3 = T.C. Type D	14 = RTD Type Pt 100 ANSI
4 = T.C. Type E	15 = RTD Type Pt 100 Din
5 = T.C. Type G2	16 = RTD Type Ni 120
6 = T.C. Type J	17 = RTD Type Pt 500
7 = T.C. Type K	18 = RTD Type Pt 1000
8 = T.C. Type L	19 = Square Root
9 = T.C. Type Ni/Ni	20 = Custom Curve
10 = T.C. Type PL2	

20	Input Source (SourCE)	1	R/W

Note: Attempting to write a new Input Source that does not match the type of the current linearization, will result in an error response of illegal data value. You must first change the linearization, then change the source.

0 = Volts
1 = milli-Volts
2 = RTD
3 = T.C. w/internal CJC
4 = T.C. w/External CJC
5 = Strain Gauge

21	Input Filter (FiLtEr)	1	R/W
22	PV Units (UnitS)	1	R/W

Note: If the current input type is T.C. or RTD, the selection of units determines the PV calculated value (deg. C or deg. F). Any selection other than "F" will default to a degree's C calculation.

0 = degree's C ("C")	10 = "J"
1 = degree's F ("F")	11 = "L"
2 = <blank>	12 = "n"
3 = "A"	13 = "o"
4 = "b"	14 = "P"
5 = "d"	15 = "r"
6 = "E"	16 = "t"
7 = "G"	17 = "U"
8 = "H"	18 = "Y"
9 = "i"	

Parameter Address	Parameter	Resolution	Access
23	Input Point 1 (in 1)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
24	Display Point 1 (dS 1)	Same as PV	R/W
25	Input Point 2 (in 2)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
26	Display Point 2 (dS 2)	Same as PV	R/W

Note: Input Points 1 and 2, and Display Points 1 and 2 determine the PV scaling for input linearization types "Linear" and "Square Root" Points 3 through 11 are only used for input linearization type "Custom".

27	Input Point 3 (in 3)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
28	Display Point 3 (dS 3)	Same as PV	R/W
29	Input Point 4 (in 4)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
30	Display Point 4 (dS 4)	Same as PV	R/W
31	Input Point 5 (in 5)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
32	Display Point 5 (dS 5)	Same as PV	R/W
33	Input Point 6 (in 6)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
34	Display Point 6 (dS 6)	Same as PV	R/W
35	Input Point 7 (in 7)	Volt Source = 0.001 V	R/W
36	Display Point 7 (dS 7)	Same as PV	R/W
37	Input Point 8 (in 8)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
38	Display Point 8 (dS 8)	Same as PV	R/W
39	Input Point 9 (in 9)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
40	Display Point 9 (dS 9)	Same as PV	R/W
41	Input Point 10 (in 10)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
42	Display Point 10 (dS 10)	Same as PV	R/W
43	Input Point 11 (in 11)	Volt Source = 0.001 V mV In Source = 0.1 mV	R/W
44	Display Point 11 (dS 11)	Same as PV	R/W
45	CJC mV at 0 deg C	1	R/W
46	CJC mV at 20 deg C	1	R/W
47	CJC mV at 60 deg C	1	R/W
48	PV Offset (OFFSEt)	Same as PV	R/W
49	External CJC Temp (E CJ)	0.1	R/W

Parameter Address	Parameter	Resolution	Access
50	PV Decimal Place (dEC Pt) 0 = "XXXXX." 1 = "XXXX.X" 2 = "XXX.XX" 3 = "XX.XXX" 4 = "X.XXXX"	1	R/W
51	Digital Input Type (ContC) 0 = OFF 1 = External Alarm Acknowledge 2 = External Peak Reset 3 = External Strain Gauge Low Calibrate 4 = External Strain Gauge High Calibrate 5 = External Strain Gauge F1 Calibrate	1	R/W
52	Key Alarm Access (AL ACC) 0 = No 1 = Yes	1	R/W
53	Strain Gauge Cal Acc. (SG ACC) 0 = No 1 = Yes	1	R/W
54	Software Revision (rEv no)	0.01	R/O
55	Key Config. Password (PASS)	1	R/W
56	Alarm 1 Type (AL 1 tP) 0 = OFF 1 = Low 2 = High 3 = Dead Band 4 = Rate	1	R/W
57	Alarm 1 Latch Enable (AL 1LAt) 0 = Not Latching 1 = Latching	1	R/W
58	Alarm 1 Setpoint (AL 1 SP)	Same as PV	R/W
59	Alarm 1 Dead Band (AL 1 db)	Same as PV	R/W
60	Alarm 1 Hysteresis (AL 1 HY)	Same as PV	R/W
61	Alarm 2 Type (AL 2 tP) 0 = OFF 1 = Low 2 = High 3 = Dead Band 4 = Rate	1	R/W
62	Alarm 2 Latch Enable (AL 2LAt) 0 = Not Latching 1 = Latching	1	R/W

Parameter Address	Parameter	Resolution	Access
63	Alarm 2 Setpoint (AL 2 SP)	Same as PV	R/W
64	Alarm 2 Dead Band (AL 2 db)	Same as PV	R/W
65	Alarm 2 Hysteresis (AL 2 HY)	Same as PV	R/W
66	Analog Output Type (outPut) 0 = OFF 1 = 0 - 20 mA 2 = 4 - 20 mA	1	R/W
67	Analog Output PV Low (An Lo)	Same as PV	R/W
68	Analog Output PV High (An Hi)	Same as PV	R/W
69	Comms Protocol (CoProt) 0 = OFF 1 = JBUS/MODBUS w/Even Parity 2 = JBUS/MODBUS w/Odd Parity 3 = JBUS/MODBUS w/No Parity	1	R/W
70	Comms Slave Address (Addr)	1	R/W
71	Comms Baud Rate (BAUd) 0 = 1200 Baud 1 = 2400 Baud 2 = 4800 Baud 3 = 9600 Baud 4 = 19,200 Baud	1	R/W
72	Comms Access (CoAcc) 0 = OFF - All Configuration is Read Only 1 = Alarm Configuration Only (all other is read only) 2 = Full - All Configuration is Writable.	1	R/W
73	Comms Decimal Place (Codpt) 0 = "XXXXX." 1 = "XXXX.X" 2 = "XXX.XX" 3 = "XX.XXX" 4 = "X.XXXX"	1	R/W

Addresses 74 through 120 are not used and cause an error response of illegal parameter address.

121	Company ID Code (see 5.1.1.2)	1	R/O
122	Model Number (see 5.1.1.3)	1	R/O
123	Software Revision (see 5.1.1.4)	1	R/O
124	Serial No. Hi (hi of 32-bit int)	1	R/O
125	Serial No. Low (low of 32-bit int)	1	R/O

Address 126 and all addresses greater are invalid.

5.2.1 Hexadecimal Coded Words:

5.1.1.1 Status Word (Address 04):
Status Word Definition for Read:

(LSB)	Bit 0	-	(1) = Unacknowledged Alarm 1
	Bit 1	-	(1) = Unacknowledged Alarm 2
	Bit 2	-	(1) = Alarm 1 active
	Bit 3	-	(1) = Alarm 2 active
	Bit 4	-	(1) = Digital Input 1 low (closed)
	Bit 5	-	(1) = PV out of range
	Bit 6	-	(1) = Parameter Changed with Key
	Bit 7	-	Not Used
	Bit 8	-	Not Used
	Bit 9	-	Not Used
	Bit 10	-	Not Used
	Bit 11	-	Not Used
	Bit 12	-	Not Used
	Bit 13	-	Not Used
	Bit 14	-	Not Used
(MSB)	Bit 15	-	Not Used

Status Word Definition for Write:

(LSB)	Bit 0	-	(0) = Acknowledge (reset) Alarm 1
	Bit 1	-	(0) = Acknowledge (reset) Alarm 2
	Bit 2	-	No Function
	Bit 3	-	No Function
	Bit 4	-	No Function
	Bit 5	-	No Function
	Bit 6	-	(0) = Reset Parameter Chg'd Flag
	Bit 7	-	Not Used
	Bit 8	-	Not Used
	Bit 9	-	Not Used
	Bit 10	-	Not Used
	Bit 11	-	Not Used
	Bit 12	-	Not Used
	Bit 13	-	(1) = Strain Gauge Low Adjust
	Bit 14	-	(1) = Strain Gauge High Adjust
(MSB)	Bit 15	-	(1) = Strain Gauge Full Adjust

5.2.1.2 Company ID Code (Word Address 121):
This value is transmitted as 4 hexadecimal digits "0500".

5.2.1.3 Model Number (Word Address 122):
This value is transmitted as 4 hexadecimal digits "9500"

5.2.1.4 Software Revision (Word Address 123):
value is transmitted as 4 hexadecimal digits "MMmm".
MM = Major version number
mm = Minor version number
"0100" is translated as version "1.0".

5.3 Bit Addressable Parameters:

Address	*Parameter*	*Access*
0	Not Used	---
1	(1) = PV out of range	R/O
2	Not Used	---
3	Not Used	---
4	(1) = Alarm 1 or 2 Active	R/O
5	(1) = Alarm 1 Active	R/O
6	(1) = Alarm 2 Active	R/O
7	(1) = Unacknowledged Alarm 1 or 2	R/O
8	(1) = Unacknowledged Alarm 1 *(write of 0 acknowledges alarm 1)*	R/W
9	(1) = Unacknowledged Alarm 2 *(write of 0 acknowledges alarm 2)*	R/W
10	(1) = PV out of range	R/O
11	(1) = Digital Input 1 Active	R/O
12	(1) = Reset has occurred *(write of 0 clears flag)*	R/W
13	(1) = Parameter Changed with Key *(write of 0 clears flag)*	R/W
14	(1) = Strain Gauge Low Adjust *(write of 1 performs Strain Gauge Low Adjust)*	W/O
15	(1) = Strain Gauge High Adjust *(write of 1 performs Strain Gauge High Adjust)*	W/O
16	(1) = Strain Gauge Full Adjust *(write of 1 performs Strain Gauge Full Adjust)*	W/O

6.0 Indicator Instrument Configuration:

The following are the communications configuration parameters for the Indicator:

6.1 Communications Protocol:

"CoProt" - "OFF" - communications disabled.

"JbuS E" - a JBUS/MODBUS RTU slave device with even parity.

"JbuS O" - a JBUS/MODBUS RTU slave device with odd parity.

"JbuS n" - a JBUS/MODBUS RTU slave device with no parity.

6.2 Indicator Device Address:

"Addr" - 1 to 255

6.3 Baud Rate:

"bAUd" - "1200"
"2400"
"4800"
"9600"
"19200"

6.4 Communications Access Mode:

"CoAcc" - "OFF" - All Configuration is Read Only.

"A OnlY" - Alarm Configuration is writable (all other configuration is Read Only).

"Full" - All Configuration is writable.

6.5 Communications Process Value Decimal Place:

"Codpt" - "XXXXX."
"XXXX.X"
"XXX.XX"
"XX.XXX"
"X.XXXX"

This parameter sets the conversion factor (multiplier) for transmitting the Process Value and all other process value related floating point configuration (see individual parameter resolutions in section 5.1).

For example:

Real Value:	10.001
Comms Decimal Place:	3
Conversion:	RoundOff(10.001 * 10^3)
Value to Transmit:	10001

7.0 References:

Refer to the following documents for further information:

Gould	MODBUS Protocol Reference Guide, PI-MBUS-300
APRIL	JBUS Specification
EIA Standard RS-422	Electrical Characteristics of Balanced Voltage Digital interface Circuits
EIA Standard RS-485	Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems

8.0 Warranty:

Warranty Statement

This product is warranted against defect in materials and workmanship for the specified period from the date of shipment. During the warranty period the manufacturer will, at its option, either repair or replace products which prove to be defective.

Warranty service at the buyer's facility can be provided only upon prior agreement by the manufacturer or its representative, and the buyer may be required to pay round-trip travel expenses.

In all cases the buyer has the option of returning the product for Warranty service to a facility designated by the manufacturer or its representatives. The buyer shall prepay shipping charges for products returned to a service facility, and the manufacturer or its representative shall pay normal charges for the return of the product to the buyer.

Limitation of Warranty

The foregoing warranty shall not apply to defects arising from:

Unauthorized modification or misuse.

Use with improper or inadequate associated operating equipment.

Improper or inadequate maintenance of the product or any associated operating equipment by the user.

Operation of the product in unfavorable environments, especially high temperatures, high humidity, and dirt, dust or other damaging atmospheres.

Disclaimer

No other warranty is expressed or implied. The manufacturer specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided above are the buyer's sole and exclusive remedies. The manufacturer shall not be liable for any direct, indirect, special incidental or consequential damages.