47D Series Digital Panel Meters

Modbus Protocol Reference Guide

CONTENTS

1. INTRODUCTION

This Reference Guide explains the 47D series specifications regarding Modbus protocol.

In this manual, descriptions given with the following symbols are applied only to the models those symbols are assigned to. Other descriptions with no specific symbol are applied to all 47D Series models.

Model No.	Function	Symbol
47DV	DC voltage input	**VV**
	DC current input	**VA**
	DC voltage/current input	**V**
47DT	Thermocouple input	**T**
47DR	RTD input	**R**
47DM	Potentiometer input	**M**
47DAC	AC voltage input	**ACV**
	AC current input	**ACA**
	AC voltage/current input	**AC**

Please refer to the operating manual for respective models regarding detailed functions of each parameter.

2. MODBUS PROTOCOL

2.1 GENERAL DESCRIPTIONS

The 47D Series Digital Panel Meter (referred hereunder as 'the device') is applicable with Modbus RTU mode. ASCII mode is not usable.

Detailed information about Modbus Protocol is described in MODBUS APPLICATION PROTOCOL V1.1a / Modbus over Serial Line Specification & Implementation Guide V1.0, provided at Modbus-IDA (http://www.modbus.org/).

2.2 TRANSMISSION SETTING

Device address, baud rate, parity check type and other properties are selectable via the control buttons at the front of the device. It is also possible to change these settings via Modbus communication.

COMM. PROPERTY	SELECTION
Modbus address	1 to 247 Factory setting : 1
Baud rate	1200 bps 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps (*)
Parity bit	None Odd (*) Even
Stop bit	1 bit (*) 2 bits
T1.5 timer length	0.1 to 6.0, in 0.1 increments (Modbus protocol standard: 1.5) Factory setting : 1.5
T3.5 timer length	0.1 to 6.0, in 0.1 increments (Modbus protocol standard: 3.5) Factory setting : 3.5
Long register (32-bit words assignments)	Normal : Low-digit word at lower address (*) Swap : High-digit word at lower address

(*) Factory setting

The following parameters are fixed.

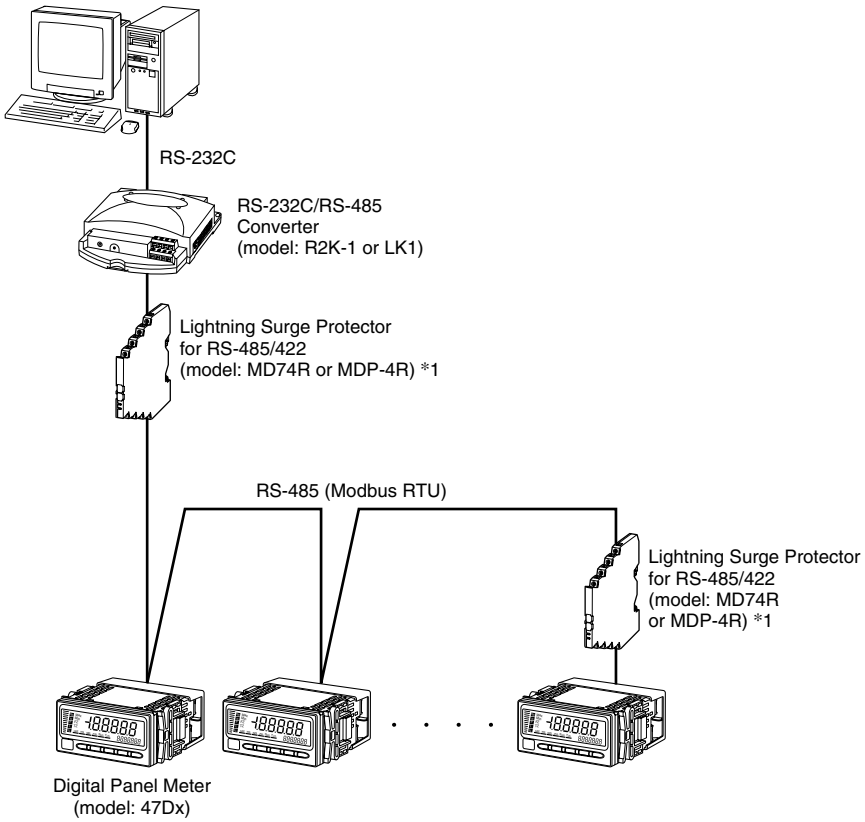
COMM. PROPERTY	SELECTION
Data bit	8 bits
Flow control	No

2.3 SYSTEM CONFIGURATION EXAMPLES

Network system configurations connecting the (slave) device to the (master) PC are as in the following examples:

CAUTION !
DO NOT attempt communication and setting at once for multiple devices. Transmissions may be mixed up and unexpected setting changes may occur.

■ RS-485 / RS-232C

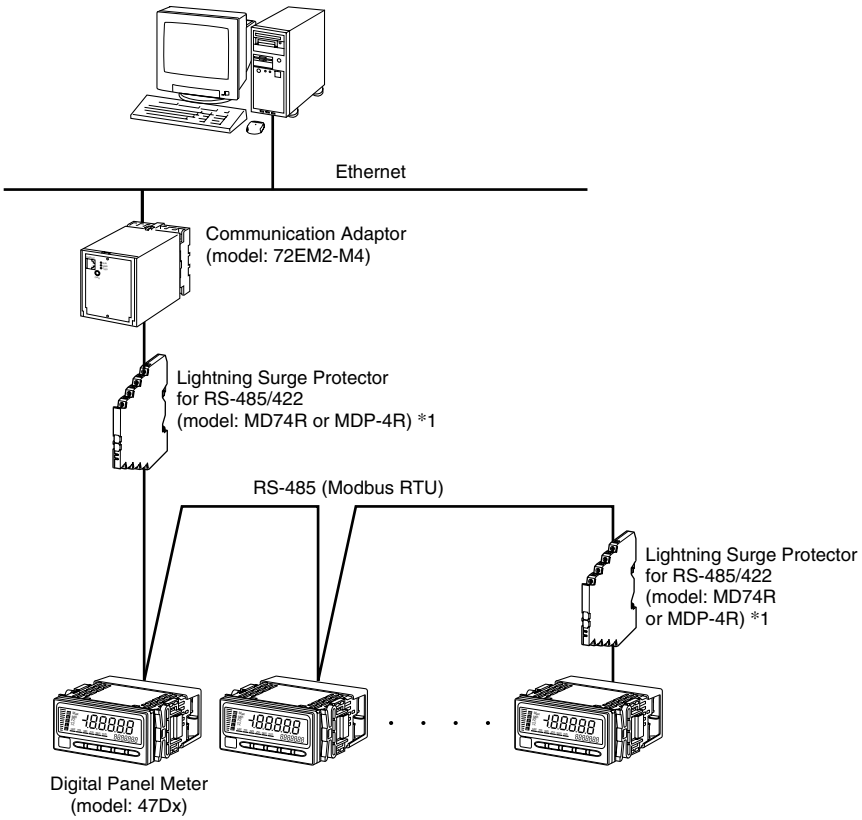


*1. Insert lightning surge protectors recommended in this example if necessary.

Set Modbus properties as in the table below:

Modbus address	Assign independent address to each device.
Baud rate	Identical setting for all devices connected via the RS-232C/RS-485 Converter.
Parity bit	Identical setting for all devices connected via the RS-232C/RS-485 Converter.
Stop bit	Identical setting for all devices connected via the RS-232C/RS-485 Converter.

■ RS-485 / ETHERNET



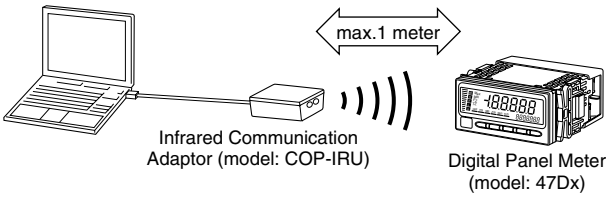
*1. Insert lightning surge protectors recommended in this example if necessary.

Set Modbus properties as in the table below:

Modbus address	Assign independent address to each device.
Baud rate	19200 bps or 38400 bps: Set identical to the 72EM2-M4.
Parity bit	Odd
Stop bit	1 bit

■ INFRARED PORT

Turn the device to the infrared communication mode. Modbus address is automatically fixed at '1' regardless of the preset value.



Note 1. Hold down Alarm/↓ + Up buttons at once for ≥3 seconds to move on to Infrared Communication mode (IRU indicated).
Hold down Alarm/↓ or Scale/↑ button for 1 second to cancel the mode.
Analog output and Modbus functions are stopped while in this mode.

Note 2. The COP-IRU can communicate with single panel meter only. DO NOT turn more than one panel meter on to the infrared communication mode.

2.4 MODBUS MESSAGE FRAMING

The following commands are usable to communicate with the device.

FUNCTION CODE	COMMAND	RECOMMENDED TIME OUT VALUE
03	Read Holding Registers	0.5 second
16	Write Multiple Registers	2.0 seconds

When accessing two-word registers, it must be specified in the command to read/write two consecutive registers. If the master sends a request to two-word registers without specifying it, the device returns Exception (error).

The lower digit word in two-word registers is assigned to the lower address (n), while the upper digit word is assigned to the higher address (n+1). The order can be reversed by programming.

All registers are in the form of integer. Floating point or other formats are not used.

2.4.1 READ HOLDING REGISTERS

This function code is used to read the contents of a contiguous block of holding registers (measured values and settings) in the remote device.

■ REQUEST FORMAT

	FIELD	LENGTH	RANGE
(1)	Device address	1 byte	1 to 247
(2)	Function code	1 byte	03
(3)	Starting address	2 bytes	0 to 65535 Address numbered minus 1 from the register described in the tables in Section 3.
(4)	Number of registers	2 bytes	1 to 125
(5)	CRC	2 bytes	

■ RESPONSE FORMAT

	FIELD	LENGTH	RANGE
(1)	Device address	1 byte	1 to 247
(2)	Function code	1 byte	03
(3)	Byte count	1 byte	N x 2 N = Number of registers
(4)	Register value	N x 2 bytes	
(5)	CRC	2 bytes	

■ REQUEST EXAMPLE

Here is an example of a request to read 2 registers starting at the register 3 in the device address 1.

01	03	0002	0002	65CB
(1)	(2)	(3)	(4)	(5)

■ RESPONSE EXAMPLE

Here is an example of a response to read ‘0009’ at the register 3, ‘0000’ at the register 4. The register 3 ranges for two words, thus the register value shows ‘00000009.’

01	03	04	00090000	2A31
(1)	(2)	(3)	(4)	(5)

The above examples are given in hexadecimal.

2.4.2 WRITE MULTIPLE REGISTERS

This function code is used to write a block of contiguous registers (settings) in the remote device.

■ REQUEST FORMAT

	FIELD	LENGTH	RANGE
(1)	Device address	1 byte	1 to 247
(2)	Function code	1 byte	16
(3)	Starting address	2 bytes	0 to 65535 Address numbered minus 1 from the register described in the tables in Section 3.
(4)	Number of registers	2 bytes	1 to 123
(5)	Byte count	1 byte	N x 2 N = Number of registers
(6)	Register value	N x 2 bytes	
(7)	CRC	2 bytes	

■ RESPONSE FORMAT

	FIELD	LENGTH	RANGE
(1)	Device address	1 byte	1 to 247
(2)	Function code	1 byte	16
(3)	Starting address	2 bytes	0 to 65535 Address numbered minus 1 from the register described in the tables in Section 3.
(4)	Number of registers	2 bytes	1 to 123
(5)	CRC	2 bytes	

■ REQUEST EXAMPLE

Here is an example of a request to write ‘6600’ (000019C8) at the 2-word register 5604 (15E3) in the device address 1.

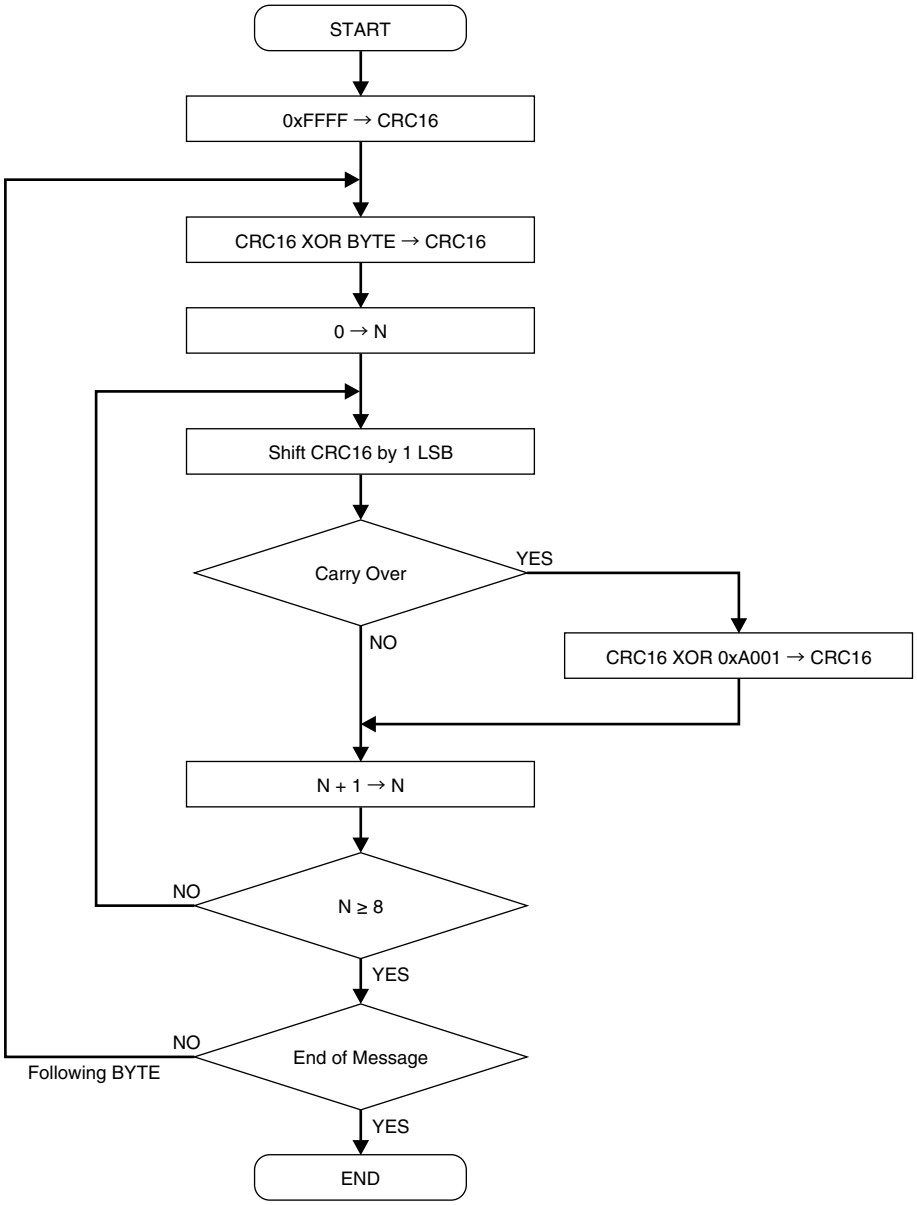
01	10	15E3	0002	04	19C80000	C9C0
(1)	(2)	(3)	(4)	(5)	(6)	(7)

■ RESPONSE EXAMPLE

01	10	15E3	0002	B432
(1)	(2)	(3)	(4)	(5)

The above examples are given in hexadecimal.

2.4.3 CRC CALCULATION ALGORITHM



Figures starting with 0x are hexadecimal.

The following shows Visual Basic 6.0 sources to calculate the CRC16.

```
Function CRC16(Message() As Byte, Size As Integer) As Integer
Dim I As Integer, N As Integer, CarryBit As Boolean
CRC16 = &HFFFF
For I = 0 To Size - 1
     CRC16 = (CRC16 And &HFF00) Or ((CRC16 And 255) Xor Message(I))
     For N = 1 To 8
          CarryBit = CRC16 And 1
          CRC16 = ((CRC16 And &HFFFE) \ 2) And &H7FFF
          If CarryBit Then CRC16 = &HA001 Xor CRC16
     Next
Next
End Function
```

3. MODBUS REGISTERS

3.1 DEVICE INFORMATION

ADDR.	WORD	CONTENTS
9601	1	Device ID Shows the device model number. 2001 : 47DV 2002 : 47DT 2003 : 47DR 2004 : 47DM 2005: 47DAC
9602	1	Extension function flag Shows the optional functions for the hardware model as the total of the function numbers. 1 : DC output 2 : Network interface (RS-485 / Modbus RTU) 4 : Alarm output (N.O. contact x 4) 8 : Alarm output (SPDT contact x 2) 16 : DC current input V / AC current input AC (DC or AC voltage input without this flag)
9603	1	Reserved
9604	1	Hardware version Version number x 100 [Example] Version 1.00 = 100
9605	1	Firmware version Version number x 100 [Example] Version 1.00 = 100
9606	8	Serial number ASCII characters. Each character is assigned in the following order. Blank bits after the last digit of the model number are filled with 0's. Offset / High-order byte / Low-order byte +0 / 2nd character / 1st character +1 / 4th character / 3rd character +2 / 6th character / 5th character +3 / 8th character / 7th character +4 / 10th character / 9th character +5 / 12th character / 11th character +6 / 14th character / 13th character +7 / 16th character / 15th character
9614	16	Model number (factory shipped) ASCII characters. Each character is assigned in the following order. Blank bits after the last digit of the model number are filled with 0's. Offset / High-order byte / Low-order byte +0 / 2nd character / 1st character +1 / 4th character / 3rd character +2 / 6th character / 5th character +3 / 8th character / 7th character +4 / 10th character / 9th character +5 / 12th character / 11th character +6 / 14th character / 13th character +7 / 16h character / 15th character +8 / 18th character / 17th character +9 / 20th character / 19th character +10 / 22th character / 21th character +11 / 24th character / 23th character +12 / 26th character / 25th character +13 / 28th character / 27th character +14 / 30th character / 29th character +15 / 32th character / 31th character
9630	2	Reserved
9632	16	Tag name Unicode. Each character is assigned to 1 word. Master can write this register.

3.2 I/O DATA

ADDR.	WORD	CONTENTS
1	1	Device Error code

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
												P.Err	A.Err	R.Err	W.Err	I.Err

Shows the following error status when the relevant bit turns '1.'
I.Err : E^2PROM read error at the device startup
W.Err : E^2PROM write error
R.Err : E^2PROM read error
A.Err : ADC error
P.Err : Excitation supply output error

2	1	Device Status code

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
			Analog	Loop Test		Burnout	S.under	S.over				HH	H	P	L	LL

Shows the following device status when the relevant bit turns '1.'
LL, L, P, H, HH : Alarm tripped
S.over : Over-scale
S.under : Under-scale
Burnout : Burnout
Loop Test : Loop Test mode
Analog : Analog output provided

3	2	Measured value *1, *2
5	2	Measured value, MAX *1, *2
7	2	Measured value, MIN *1, *2
9	2	Reserved
11	2	Reserved
13	2	Reserved
15	2	Reserved
17	2	Reserved
19	2	Reserved
21	2	Reserved
23	2	Analog output value *2, *3
25	2	Reserved
27	2	Reserved
29	2	Reserved
31	2	Reserved
33	2	Reserved
35	2	Reserved
37	2	Reserved
39	2	Reserved
41	2	Reserved

*1. **V M AC** Only normally measured signals are applied to Max and Min values. Values during scaling errors are not. Values other than in normal measuring conditions are indefinite.
*2. Display value, Max value, Min value and Analog output are indefinite during the infrared communication mode.
*3. Analog output is valid only when the device status code for the analog output equals '1.' It is indefinite when the code equals '0.'

3.3 DEVICE CONTROL

ADDR.	WORD	CONTENTS
801	1	Bank No. Different sets of alarm setpoints and properties (Banks) can be selected when Master writes 1 ... 8. In order to activate this setting, Bank Switching via communication must be enabled at Register 4009. This register is reset to ‘1’ at the device startup.
802	1	Reset MIN / MAX values MIN / MAX reading currently on the display is reset when ‘1’ is set. The register value is automatically reset again to ‘0’ when the MAX / MIN value resetting action is complete. If another value is set before ‘0,’ the resetting result becomes undefined.

3.4 LOCKOUT SETTING

ADDR.	WORD	CONTENTS
901	1	Modbus register access control 0 : Read only (*) 1 : Write enabled This register is reset to ‘0’ at the device startup. Write ‘1’ before starting writing other registers. Once ‘1’ is set, alarm and analog outputs are held at the last value and status before it has been turned ‘1.’ With ‘0,’ these outputs respond to the input signal.
902	1	Alarm setting lockout 0 : Completely unlock alarm settings 1 : Partially unlock alarm settings (Refer to the 47Dx operating manual for detailed information.) (*) 2 : Lock alarm settings
903	1	Scaling setting lockout 0 : Unlock scaling settings (*) 1 : Lock alarm settings
904	1	Advanced setting lockout 0 : Completely unlock advanced settings 1 : Partially advanced alarm settings (Refer to the 47Dx operating manual for detailed information.) (*) 2 : Lock advanced settings
905	1	Modbus setting lockout 0 : Lock Modbus settings 1 : Unlock Modbus settings (*)
906	1	MAX/MIN display control lockout 0 : Unlock MAX/MIN Display control (*) 1 : Lock MAX/MIN Display reset 2 : Lock MAX/MIN Display control
907	1	Forced zero control lockout V M AC 0 : Unlock Forced Zero and Tare Adjustment control (*) 1 : Unlock Forzed Zero control / Lock Tare Adjustment control 2 : Lock Forced Zero and Tare Adjustment control
908	1	Loop test output lockout 0 : Unlock Loop Test Output mode (*) 1 : Lock Loop Test Output Mode

(*): Factory setting

3.5 INPUT SETTING

3.5.1 COMMON SETTING

ADDR.	WORD	CONTENTS	UNIT
1001	1	Averaging type 0 : Simple average 1 : Moving average (*)	
1002	1	Averaging time 0 : No averaging (*) 1 : 2 samples 2 : 4 samples 3 : 8 samples 4 : 16 samples 5 : 32 samples 6 : 64 samples 7 : 128 samples 8 : 256 samples 9 : 512 samples	
1003	1	High-pass filter 0 : High-pass filter OFF (*) 1 : High-pass filter ON	
1011	1	Low-end cutout 0 : Low-end cutout OFF (*) 1 : Low-end cutout ON 2 : Low-end cutout by absolute value	
1012	1	Low-end cutout value 0 ... 999 Factory setting : 0	V M AC Decimal point position setting T R °C/100 or °F/100

3.5.2 FORCED ZERO, TARE ADJUSTMENT V M AC

ADDR.	WORD	CONTENTS
1021	1	Forced zero 0 : Disable Forced zero (*) 1 : Enable Forced zero 2 : Enable Tare adjustment
1022	2	Force zero value Set value : -20000 ... 100000
1024	2	Tare adjustment value Set value : -20000 ... 100000

3.5.3 DC VOLTAGE/CURRENT INPUT V

ADDR.	WORD	CONTENTS
1051	1	Input type **VV** 0 : 1 to 5V (*) 1 : -5 to +5V 2 : ±20V 3 : ±200V **VA** 0 : 4 to 20mA (*) 1 : 0 to 20mA 2 : ±20mA 3 : ±200mA
1053	2	Input scaling value Zero Selectable range depends upon the input type. Input Type / Selectable Range / Unit **VV** 1 to 5V / 10000 ... 50000 / V/10000 -5 to +5V / -5000 ... 5000 / V/1000 ±20V / -20000 ... 20000 / V/1000 ±200V / -20000 ... 20000 / V/100 **VA** 4 to 20mA / 04000 ... 20000 / mA/1000 0 to 20mA / 00000 ... 20000 / mA/1000 ±20mA / -20000 ... 20000 / mA/1000 ±200mA / -20000 ... 20000 / mA/100 Factory setting : **VV** 10000 / **VA** 04000
1055	2	Input scaling value Span Refer to Input scaling value Zero for selectable ranges. Factory setting : **VV** 50000 / **VA** 20000
1057	2	Display scaling value Zero -20000 ... 100000 Factory setting : **VV** 10000 / **VA** 04000
1059	2	Display scaling value Span -20000 ... 100000 Factory setting : **VV** 50000 / **VA** 20000
1061	1	Display decimal point position Applied to the scaling values and other values set in the scaled range. 0 : 00000 1 : 0000.0 2 : 000.00 3 : 00.000 4 : 0.0000 Factory setting : **VV** 0.0000 / **VA** 00.000

3.5.4 POTENTIOMETER INPUT M

ADDR.	WORD	CONTENTS
1057	2	Display scaling value Zero -20000 ... 100000 Factory setting : -10000
1059	2	Display scaling value Span -20000 ... 100000 Factory setting : 10000
1061	1	Display decimal point position Applied to the scaling values and other values set in the scaled range. 0 : 00000 1 : 0000.0 2 : 000.00 (*) 3 : 00.000 4 : 0.0000

3.5.5 RTD INPUT R

ADDR.	WORD	CONTENTS	UNIT
1051	1	Input type 0 : JPt 100 (JIS '89) 1 : Pt 100 (JIS '89) 2 : Pt 100 (JIS '97, IEC) (*) 3 : Pt 50 (JIS '81) 4 : Pt 1000	
1052	1	Temperature unit 0 : °C (*) 1 : °F	
1063	1	Burnout 0 : Downscale 1 : Upscale (*)	
1065	2	Input compensation A input value *5 -99999 ... 999999 Factory setting : 000	°C/100 or °F/100
1067	2	Input compensation B input value *5 -99999 ... 999999 Factory setting : 8000	°C/100 or °F/100
1069	2	Input compensation A compensation value -99999 ... 999999 Factory setting : 0	°C/100 or °F/100
1071	2	Input compensation B compensation value -99999 ... 999999 Factory setting : 0	°C/100 or °F/100

*5. Input compensation is not executed when the A and B values are equal.

3.5.6 THERMOCOUPLE INPUT T

ADDR.	WORD	CONTENTS	UNIT
1051	1	Input type 0 : (PR) 1 : K (CA) 1 (*) 2 : K (CA) 2 3 : E (CRC) 4 : J (IC) 1 5 : J (IC) 2 6 : T (CC) 7 : B (RH) 8 : R 9 : S 10 : C (WRe5-26) 11 : N 12 : U 13 : L	
1052	1	Temperature unit 0 : °C (*) 1 : °F	
1063	1	Burnout 0 : Downscale 1 : Upscale (*)	
1064	1	Cold junction compensation 0 : ON (*) 1 : OFF	
1065	2	Input compensation A input value *5 -99999 ... 999999 Factory setting : 000	°C/100 or °F/100
1067	2	Input compensation B input value *5 -99999 ... 999999 Factory setting : 100000	°C/100 or °F/100
1069	2	Input compensation A compensation value -99999 ... 999999 Factory setting : 0	°C/100 or °F/100
1071	2	Input compensation B compensation value -99999 ... 999999 Factory setting : 0	°C/100 or °F/100

*5. Input compensation is not executed when the A and B values are equal.

3.5.7 AC VOLTAGE/CURRENT INPUT V

ADDR.	WORD	CONTENTS
1051	1	Input type ACV 0 : 0 to 0.2V 1 : 0 to 2V 2 : 0 to 20V 3 : 0 to 200V (*) ACA 0 : 0 to 0.2mA 1 : 0 to 2mA 2 : 0 to 20mA 3 : 0 to 200mA
1053	2	Input scaling value Zero Selectable range depends upon the input type. Factory setting : 000000 / 000000
1055	2	Input scaling value Span Refer to Input scaling value Zero for selectable ranges. Factory setting : VV 50000 / VA 20000
1057	2	Display scaling value Zero -20000 ... 100000 Factory setting : VV 10000 / VA 04000
1059	2	Display scaling value Span -20000 ... 100000 Factory setting : VV 50000 / VA 20000
1061	1	Display decimal point position Applied to the scaling values and other values set in the scaled range. 0 : 00000 1 : 0000.0 2 : 000.00 3 : 00.000 4 : 0.0000 Factory setting : VV 0.0000 / VA 00.000

Input Type		Selectable Range	Unit
ACV	0 to 0.2V	000000 to 002000	V/1000
	0 to 2V	000000 to 002000	V/1000
	0 to 20V	000000 to 020000	V/1000
	0 to 200V (*)	000000 to 020000	V/100
ACA	0 to 0.2mA	000000 to 002000	mA/1000
	0 to 2mA	000000 to 002000	mA/1000
	0 to 20mA	000000 to 020000	mA/1000
	0 to 200mA	000000 to 020000	mA/100

3.6 BARGRAPH SETTING

ADDR.	WORD	CONTENTS
2001	1	Bargraph type 0 : No bargraph indication 1 : Unidirectional bar (*) 2 : Unidirectional bar, reverse LCD 3 : Bidirectional bar 4 : Bidirectional bar, reverse LCD
2002	2	Bargraph lower limit -20000 ... 100000 **V M AC** — **V M AC** Decimal point position setting -99999 ... 999999 **T R** — **T R** °C/100 or °F/100 Factory setting : **VV** 10000 / **VA** 04000 / **T** 0 / **R** 0 / **M** -10000 / **AC** 000000/000000
2004	2	Bargraph upper limit -20000 ... 100000 **V M AC** — **V M AC** Decimal point position setting -99999 ... 999999 **T R** — **T R** °C/100 or °F/100 Factory setting : **VV** 50000 / **VA** 20000 / **T** 10000 / **R** 10000 / **M** 10000 / **AC** 020000/020000

3.7 ANALOG OUTPUT SETTING

ADDR.	WORD	CONTENTS	UNIT
3001	1	Analog output type 0 : 0 to 5V 1 : -5 to +5V 2 : -10 to +10V 3 : 0 to 20mA 4 : 4 to 20mA (*)	
3002	1	Analog output function mode 0 : Proportional to the display value (*) 1 : Proportional to the scaling/temperature value	
3003	2	Analog output 0% -20000 ... 100000 **V M AC** — **V M AC** Decimal point position setting -99999 ... 999999 **T R** — **T R** °C/100 or °F/100 Factory setting : **VV** 10000 / **VA** 04000 / **T** 0 / **R** 0 / **M** -10000 / **AC** 000000/000000	
3005	2	Analog output 100% -20000 ... 100000 **V M AC** — **V M AC** Decimal point position setting -99999 ... 999999 **T R** — **T R** °C/100 or °F/100 Factory setting : **VV** 50000 / **VA** 20000 / **T** 10000 / **R** 10000 / **M** 10000 / **AC** 020000/020000	
3007	2	Analog output 0% adjustment -5000 ... 100000 0% adjustment value ≤ 100% adjustment value – 5000 Factory setting : 0	%/1000
3009	2	Analog output 100% adjustment 0 ... 105000 0% adjustment value + 5000 ≤ 100% adjustment value Factory setting : 100000	%/1000

3.8 ALARM SETTING

3.8.1 COMMON SETTING

ADDR.	WORD	CONTENTS	UNIT
4001	1	Manual sub display reset 0 : Alarm setpoint display is automatically reset (*) 1 : Alarm setpoint display is manually reset	
4002	1	Display flashing rate at alarm conditions 0 : No flashing (*) 1 : Main display flashing in 1.0 (approx.) intervals 2 : Main display flashing in 0.5 (approx.) intervals 3 : Main display flashing in 0.3 (approx.) intervals	
4003	1	Alarm output pattern 0 : Normal (*) 1 : Zone	
4004	1	P output One of LL, L, H and HH output terminals can be assigned for P. 0 : No P output (*) 1 : LL 2 : L 3 : H 4 : HH 1 (LL) and 4 (HH) are usable only with the quad alarm output option.	
4005	1	Latching alarm 0 : No latching; output and measuring continued (*) 1 : Output latched / Measuring continued 2 : Output and measuring latched	
4006	1	Standby sequence 0 : Output standing by until the input signal comes into P zone after the power is turned on 1 : Output is immediately provided after the power is turned on (*)	
4007	1	Alarm trip at over-range **T R** Burnout is handled as over-range. 0 : Alarm trip action valid at over-range (*) 1 : No alarm trip action at over-range	
4008	1	Alarm power ON delay 0 ... 9999 Factory setting : 0	seconds/10
4009	1	Bank switching 0 : Disabled (*) 1 : Enabled via the front button control 2 : Enabled via Modbus communication With this register set to ‘0,’ only Bank 1 is used regardless of the settings at Register 801 or 4101. With ‘1,’ Bank No. specified at Register 4101 is used. With ‘2,’ Bank No. specified at Register 801 is used. In actual applications, use Register 801 to switch Bank No. via Modbus communication by setting this register to ‘2.’ Register 4101 is not suitable for frequent switching during operation.	

3.8.2 SETPOINTS & BANK SWITCHING

Bank 1 (Register 4102 ... 4113) is used when Bank Switching is disabled.

ADDR.	WORD	CONTENTS	UNIT
4101	1	Select Bank No. 1... 8 Factory setting : 1	
4102	1	Bank 1: LL Enable 0 : Disable 1 : Enable (*)	
4103	2	Bank 1: LL setpoint -20000 ... 100000 **V M AC** -99999 ... 999999 **T R** Factory setting : **VV** 14000 / **VA** 5600 / **T** 2000 / **R** 2000 / **M** -8000 / **AC** 2000/2000	**V M AC** Decimal point position setting **T R** °C/100 or °F/100
4105	1	Bank 1: L Enable 0 : Disable 1 : Enable (*)	
4106	2	Bank 1: L setpoint -20000 ... 100000 **V M AC** -99999 ... 999999 **T R** Factory setting : **VV** 22000 / **VA** 8800 / **T** 3000 / **R** 3000 / **M** -4000 / **AC** 6000/6000	**V M AC** Decimal point position setting **T R** °C/100 or °F/100
4108	1	Bank 1: H Enable 0 : Disable 1 : Enable (*)	
4109	2	Bank 1: H setpoint -20000 ... 100000 **V M AC** -99999 ... 999999 **T R** Factory setting : **VV** 38000 / **VA** 15200 / **T** 7000 / **R** 7000 / **M** 4000 / **AC** 14000/14000	**V M AC** Decimal point position setting **T R** °C/100 or °F/100
4111	1	Bank 1: HH Enable 0 : Disable 1 : Enable (*)	
4112	2	Bank 1: HH setpoint -20000 ... 100000 **V M AC** -99999 ... 999999 **T R** Factory setting : **VV** 46000 / **VA** 18400 / **T** 8000 / **R** 8000 / **M** 8000 / **AC** 18000/18000	**V M AC** Decimal point position setting **T R** °C/100 or °F/100
4114 : 4125	12	Bank 2 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4126 : 4137	12	Bank 3 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4138 : 4149	12	Bank 4 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4150 : 4161	12	Bank 5 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4162 : 4173	12	Bank 6 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4174 : 4185	12	Bank 7 setpoints Identical to Bank 1 setting (4102 ... 4112)	
4186 : 4197	12	Bank 8 setpoints Identical to Bank 1 setting (4102 ... 4112)	

3.8.3 ALARM TRIP ACTION

Alarm setpoints are set at selected Bank No.s (Register 4101 ...).

ADDR.	WORD	CONTENTS	UNIT
4201	1	LL trip action 0 : High 1 : Low Factory setting : 0 for HH and H, 1 for LL and L	
4202	1	LL deadband (hysteresis) 0 ... 9999 Factory setting : 1	V M AC Decimal point position setting T R °C/100 or °F/100
4203	1	LL ON delay time 0 ... 999 Factory setting : 0	seconds/10
4204	1	LL OFF delay time 0 ... 999 Factory setting : 0	seconds/10
4205	1	LL one-shot output time 0 ... 9999 Factory setting : 0	seconds/10
4206	1	LL coil energized / de-energized at alarm trip 0 : Energized (*) 1 : De-energized	
4211 : 4216	6	L alarm trip action Identical to LL setting (4201 ... 4206)	
4221 : 4226	6	H alarm trip action Identical to LL setting (4201 ... 4206)	
4231 : 4236	6	HH alarm trip action Identical to LL setting (4201 ... 4206)	
4243	1	P ON delay time 0 ... 999 Factory setting : 0	seconds/10
4244	1	P OFF delay time 0 ... 999 Factory setting : 0	seconds/10
4245	1	P one-shot output time 0 ... 9999 Factory setting : 0	seconds/10
4246	1	P coil energized / de-energized at alarm trip 0 : Energized (*) 1 : De-energized	

3.9 OPERATION CONTROL SETTING

ADDR.	WORD	CONTENTS
5001	1	Automatic return time to the measuring mode The displays can be automatically returned to the normal operation when the preset time period has been elapsed after the last front button control. 0 : Manual returning only 1 ... 99 : Seconds Factory setting : 15
5002	1	Transition time to the lockout control mode The displays can be switched to Lockout Control Mode when the designated buttons are held down for a preset time period. 0 ... 99 : Seconds Factory setting : 5

3.10 DISPLAY SETTING

ADDR.	WORD	CONTENTS	UNIT
6001	1	Display color 0 : Green (normal) to Red (alarm) (*) 1 : Green 2 : Red (normal) to Green (alarm) 3 : Red	
6002	1	Decimal fractions for temperature input **T R** 0 : No fractions 1 : 1 decimal place (*) 2 : 2 decimal places **R** (°C only)	
6003	1	Round off low-digit reading 0 : 1 (*) 1 : 2 2 : 5 3 : 10	
6004	1	Display refreshing rate 0 : Fastest possible (50 msec) (*) 1 ... 999 : Seconds	seconds/10
6005	1	Display reading type 0 : Measured value (*) 1 : Maximum value 2 : Minimun value	
6006	1	Backlight brightness 1 (dark) ... 3 (bright) Factory setting : 2	
6007	1	LCD Contrast 1 (low) ... 10 (high) Factory setting : 5	

3.11 MODBUS SETTING

Modbus setting is enabled only after the device has been reset or the power supply has been turned off and on.

ADDR.	WORD	CONTENTS
7001	1	Device address 1 ... 247 Factory setting : 1
7002	1	Baud rate 0 : 1200 bps 1 : 2400 bps 2 : 4800 bps 3 : 9600 bps 4 : 19200 bps 5 : 38400 bps (*)
7003	1	Parity bit 0 : None 1 : Odd (*) 2 : Even
7004	1	Stop bit 0 : 1 bit (*) 1 : 2 bits
7005	1	T1.5 timer 1 ... 60 (character length x10) Factory setting : 15
7006	1	T3.5 timer 1 ... 60 (character length x10) Factory setting : 35
7007	1	Long register 0 : Normal, Low-digit word at the lower address (*) 1 : Swap, High-digit word at the lower address

3.12 EVENT TRIGGER INPUT SETTING

ADDR.	WORD	CONTENTS	UNIT
8001	1	Event trigger mode 0 : Normal mode (*) 1 : Sampling hold mode 2 : Peak hold mode 3 : Valley (bottom) hold mode 4 : Peak-to-peak hold mode	
8002	1	ON timing delay 0 ... 9999 Factory setting: 0	seconds/10
8003	1	OFF timing delay 0 ... 9999 Factory setting: 0	seconds/10
8004	1	Startup timer 0 ... 999 Factory setting: 0	seconds/10

3.13 BCD OUTPUT SETTING

ADDR.	WORD	CONTENTS
8101	1	REQ, MAX_REQ, MIN_REQ input logic 0 : Request valid at OFF 1 : Request valid at ON (*)
8102	1	DAV output logic 0 : Data valid at OFF 1 : Data valid at ON (*)
8103	1	DATA output logic 0 : Negative logic open collector (*) 1 : Positive logic open collector
8104	1	Status output logic (RUN, LL, L, P, H, HH, POL, OVF) 0 : Valid at OFF 1 : Valid at ON (*)

M-SYSTEM WARRANTY

1. What is covered.

M-System Co., Ltd. ("M-System") warrants, only to the original purchaser of new M-System products purchased directly from M-System, or from M-System's authorized distributors or resellers, for its own use not for resale, that the M-System products shall be free from defects in materials and workmanship and shall conform to the specifications set forth in the product catalogue applicable to the M-System products for the Warranty Period (see Paragraph 5 below for the Warranty Period of each product).

THE ABOVE WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THE M-SYSTEM PRODUCTS AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

2. What is not covered.

This warranty does not cover any M-System product which has been: (1) modified, altered or subjected to abuse, misuse, negligence or accident; (2) improperly installed or installed in conjunction with any equipment for which it was not designed; or (3) damaged or destroyed by disasters such as fire, flood, lightning or earthquake.

In no event shall M-System be liable for any special, incidental, consequential or other damages, costs or expenses (including, but not limited to, loss of time, loss of profits, inconvenience or loss of use of any equipment).

3. Remedies.

If a defective product is returned to M-System in accordance with the procedures described below, M-System will, at its sole option and expense, either: (1) repair the defective product; (2) replace the defective product; or (3) refund the purchase price for the defective product paid by the purchaser. Except as otherwise provided by applicable state law, these remedies constitute the purchaser's sole and exclusive remedies and M-System's sole and exclusive obligation under this warranty.

4. Warranty Procedure.

If the purchaser discovers a failure of the M-System products to conform to the terms of this warranty within the Warranty Period, the purchaser must promptly (and, in any event not more than 30 days after the discovery of such failure) notify the relevant party as described below either by telephone or in writing at the below address to obtain an Authorized Return (AR) number and return the defective product to the relevant party. The designated AR number should be marked on the outside of the return package and on all correspondence related to the defective product. The purchaser shall return, at purchaser's expense, defective products only upon receiving an AR number. In order to avoid processing delays, the purchaser must include: copies of the original purchase order and sales invoice; the purchaser's name, address and phone number; the model and serial numbers of the returned product; and a detailed description of the alleged defect.

5. Warranty Period.

Signal Conditioner:	36 months from the date of purchase.
M-Rester:	12 months from the date of purchase.
Valve Actuator:	18 months from the date of shipment from M-System or 12 months from the date of its installation, whichever comes first.
Other Products:	36 months from the date of purchase.

M-SYSTEM CO., LTD.
5-2-55, Minamitsumori, Nishinari-ku,
Osaka 557-0063 JAPAN
Phone: (06) 6659-8201
Fax: (06) 6659-8510
E-mail: info@m-system.co.jp

M·SYSTEM CO.,LTD.
5-2-55, Minamitsumori, Nishinari-ku, Osaka 557-0063 JAPAN
Tel: +81-6-6659-8201 Fax: +81-6-6659-8510
http://www.m-system.co.jp
E-mail: info@m-system.co.jp