INSTRUCTION MANUAL

COMMUNICATION CONTROLLER
(DeviceNet™ use)

MODEL **M2BD**

CONTENTS

1. GENERAL DESCRIPTION

The model M2BD is an I/O Terminal Block for DeviceNet. Variety of input and output types can be mixed, selected from Mini-M series signal conditioners.

Model number and suffix codes are designated as follows:

M2BD–❑❑–❑❑

MODEL

CAPACITY
04: 4 positions
08: 8 positions
16: 16 positions

I/O TYPE
1 : Input
2 : Output

POWER INPUT
K : 85 – 132V AC*
R : 24V DC
*CE or UL not available

OPTIONS
/UL: UL approval & CE marking**
**24V DC power only. Voltage at the field terminals limited within 30V DC.

The Communication Controller Module of an Input Terminal Block converts analog inputs (0 – 100%) proportionally into 16-bit binary signals. The one for an Output Terminal Block converts 16-bit binary signals proportionally into analog outputs (0 – 100%).

This instruction manual explains hardware specifications, component identification, and wiring instructions, etc.

2. HARDWARE SPECIFICATIONS

2.1 M2BD-❑1 (suffix codes 04, 08, or 16 in ❑)

ITEM	SPECIFICATIONS	
Analog input	Refer to the data sheets for Mini-M series Signal Conditioners.	
Digital output	16-bit binary	
I/O characteristics	0 – 6000 (0 – 10000) proportional to analog input 0 – 100%	
Maximum resolution	1mV for 1 – 5V DC range	
Accuracy	≤±0.1% excluding the accuracy of I/O modules	
Maximum input voltage	Refer to the data sheets for Mini-M series Signal Conditioners. Limited to less than 30V r.m.s. and 42.4V peak or 60V DC for /UL option.	
No. of analog input channels	M2BD-041	4
	M2BD-081	8
	M2BD-161	16
Isolation	Field input to communication section to power (isolated between channels)	
Required nodes*	M2BD-041	4 (RX/RY 32 points each, RWr/RWw each 4 points)
	M2BD-081	8 (RX/RY 32 points each, RWr/RWw each 8 points)
	M2BD-161	16 (RX/RY 32 points each, RWr/RWw each 16 points)
Applicable wire size	0.75 – 2.0 mm^2	
Mounting screw for the base	M5 × 6 mm or larger	
Applicable solderless terminal	RAV 1.25-3, RAV2-2	
Noise immunity	500V p-p, 1μsec.	
Dielectric strength	1000V AC @ 1 minute (power to input module to communication section to FG1)	
Insulation resistance	≥100MΩ with 500V DC (power to input module to communication section to FG1)	
Weight	M2BD-041	approx. 1.2 kg (2.6 lbs)
	M2BD-081	approx. 1.5 kg (3.3 lbs)
	M2BD-161	approx. 2.0 kg (4.4 lbs)
Power input	M2BD-❑1-K	85 – 132V AC
	M2BD-❑1-R	24V DC ±10%
Power consumption	M2BD-❑1-K	approx. 6VA without I/O modules
	M2BD-041-K	approx. 30VA with all 4 modules
	M2BD-081-K	approx. 50VA with all 8 modules
	M2BD-161-K	approx. 90VA with all 16 modules
Current consumption	M2BD-❑1-R	approx. 0.25A without I/O modules
	M2BD-041-R	approx. 1.5A with all 4 modules
	M2BD-081-R	approx. 2.5A with all 8 modules
	M2BD-161-R	approx. 3.8A with all 16 modules
Power output	11 – 25V DC (supplied from the communication terminals); 60mA max. at 24V	

*Applicable to OMRON CompoBus/D

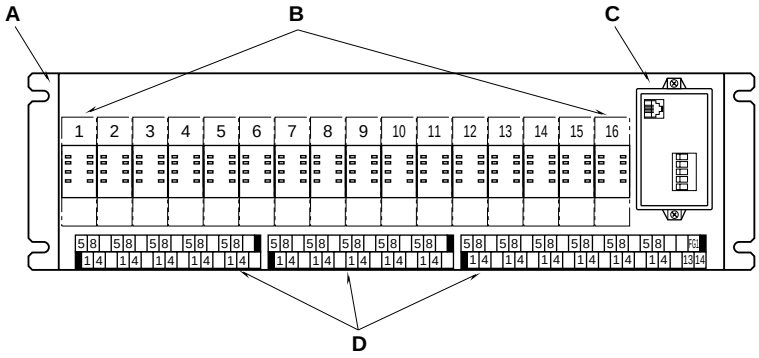
2.2 M2BD-❑2 (suffix codes 04, 08, or 16 in ❑)

ITEM	SPECIFICATIONS	
Analog output	Refer to the data sheets for Mini-M series Signal Conditioners.	
Digital input	16-bit binary	
I/O characteristics	0 – 6000 (0 – 10000) proportional to analog input 0 – 100%	
Maximum resolution	1mV for 1 – 5V DC range	
Accuracy	≤±0.1% excluding the accuracy of I/O modules	
Maximum output voltage	Refer to the data sheets for Mini-M series Signal Conditioners. Limited to less than 30V r.m.s. and 42.4V peak or 60V DC for /UL option.	
No. of analog input channels	M2BD-042	4
	M2BD-082	8
	M2BD-162	16
Isolation	Field input to communication section to power (isolated between channels)	
Required nodes*	M2BD-042	4 (RX/RY 32 points each, RWr/RWw each 4 points)
	M2BD-082	8 (RX/RY 32 points each, RWr/RWw each 8 points)
	M2BD-162	16 (RX/RY 32 points each, RWr/RWw each 16 points)
Applicable wire size	0.75 – 2.0 mm^2	
Mounting screw for the base	M5 × 6 mm or larger	
Applicable solderless terminal	RAV 1.25-3, RAV2-2	
Noise immunity	500V p-p, 1μsec.	
Dielectric strength	1000V AC @ 1 minute (power to input module to communication section to FG1)	
Insulation resistance	≥100MΩ with 500V DC (power to input module to communication section to FG1)	
Weight	M2BD-042	approx. 1.2 kg (2.6 lbs)
	M2BD-082	approx. 1.5 kg (3.3 lbs)
	M2BD-162	approx. 2.0 kg (4.4 lbs)
Power input	M2BD-❑2-K	85 – 132V AC
	M2BD-❑2-R	24V DC ±10%
Power consumption	M2BD-❑2-K	approx. 6VA without I/O modules
	M2BD-042-K	approx. 30VA with all 4 modules
	M2BD-082-K	approx. 50VA with all 8 modules
	M2BD-162-K	approx. 90VA with all 16 modules
Current consumption	M2BD-❑2-R	approx. 0.25A without I/O modules
	M2BD-042-R	approx. 1.5A with all 4 modules
	M2BD-082-R	approx. 2.5A with all 8 modules
	M2BD-162-R	approx. 3.8A with all 16 modules
Power output	11 – 25V DC (supplied from the communication terminals); 60mA max. at 24V	

*Applicable to OMRON CompoBus/D

3. COMPONENT IDENTIFICATIONS & HARDWARE ADJUSTMENTS

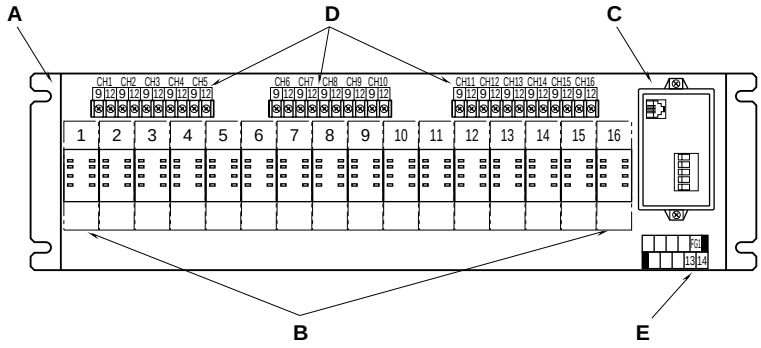
3.1 M2BD-❑1



REF.	NAME	FUNCTION
A	Base	Installation base
B	Base socket	Mounting Mini-M modules
C	Communication Controller Module	Interfacing field I/Os with DeviceNet
D	Terminal blocks	Connecting field inputs and power input

The above figure indicates model M2BD-161.

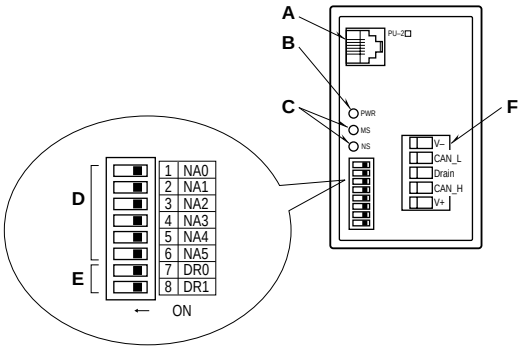
3.2 M2BD-❑2



REF.	NAME	FUNCTION
A	Base	Installation base
B	Base socket	Mounting Mini-M modules
C	Communication Controller Module	Interfacing field I/Os with DeviceNet
D	Output terminal blocks	Connecting field outputs
E	Power input terminal block	Connecting power input

The above figure indicates model M2BD-162.

3.3 COMMUNICATION CONTROLLER MODULE

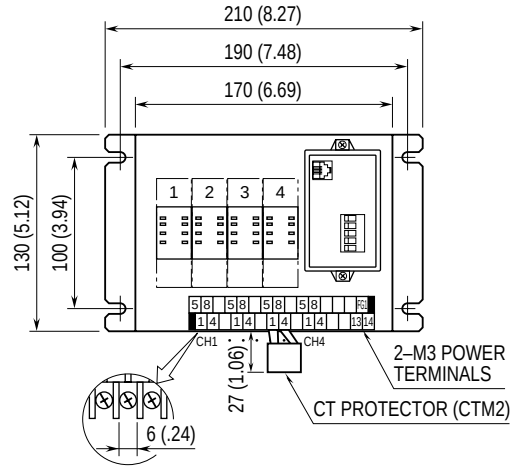


REF.	NAME	FUNCTIONS		
A	PU-2❑ modular jack	Connecting with the Programming Unit (model: PU-2❑)		
B	I/O status LED	Marking (color)		Function
		PWR (green)		ON: Power is supplied. OFF: Power is not supplied.
C	Controller status LED	Marking		Function
		MS		Indicating operating status of the Communication Controller Module.
		NS		Indicating operating status of the network.
D	Node address setting	Bit		Node Address (set with ON position)
		NA0		2^0
		NA1		2^1
		NA2		2^2
		NA3		2^3
		NA4		2^4
		NA5		2^5
E	Transmission speed	DR0	DR1	Transmission Speed
		OFF	OFF	125 kbps (factory default)
		ON	OFF	250 kbps
		OFF	ON	500 kbps
F	Data link connector	Terminal block for connecting with DeviceNet. Refer to Section 5. CONNECTING DATA LINK WIRES.		

4. EXTERNAL DIMENSIONS mm (inch)

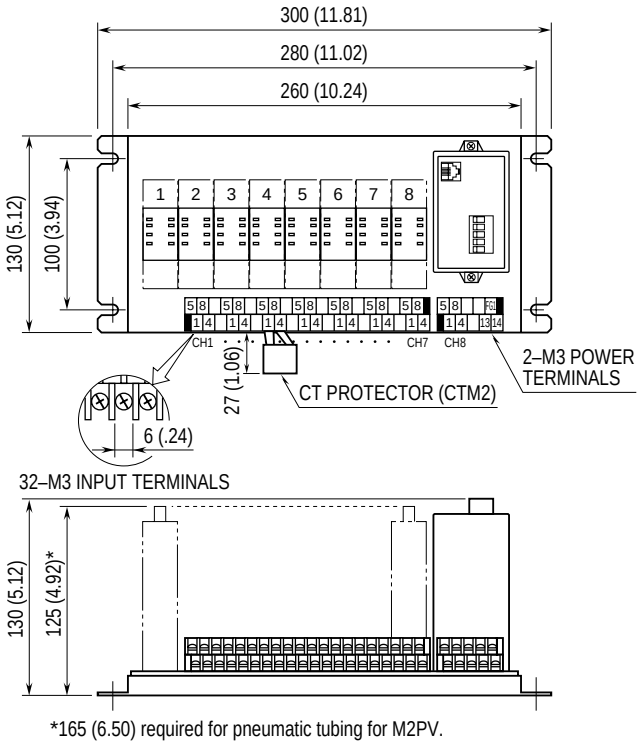
4.1 M2BD-❑1

4.1.1 M2BD-041



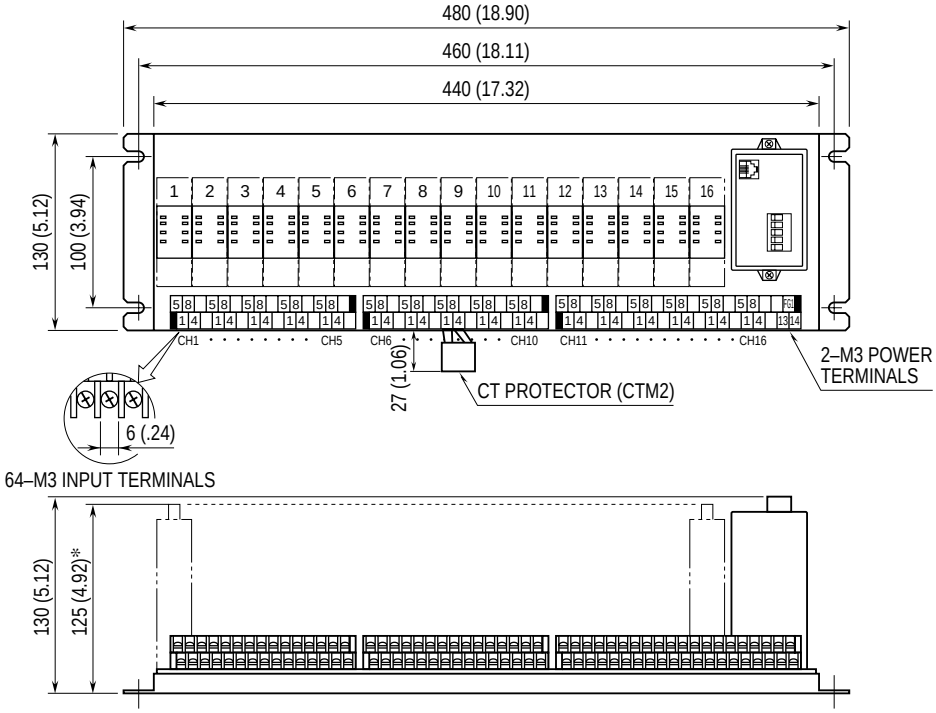
*165 (6.50) required for pneumatic tubing for M2PV.

4.1.2 M2BD-081



*165 (6.50) required for pneumatic tubing for M2PV.

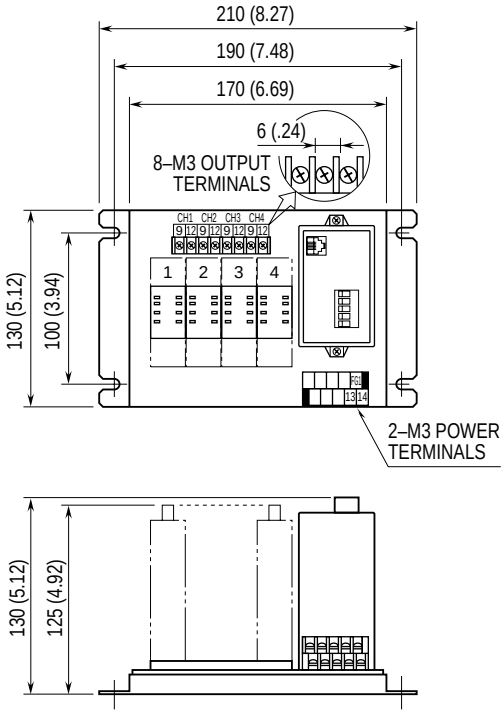
4.1.3 M2BD-161



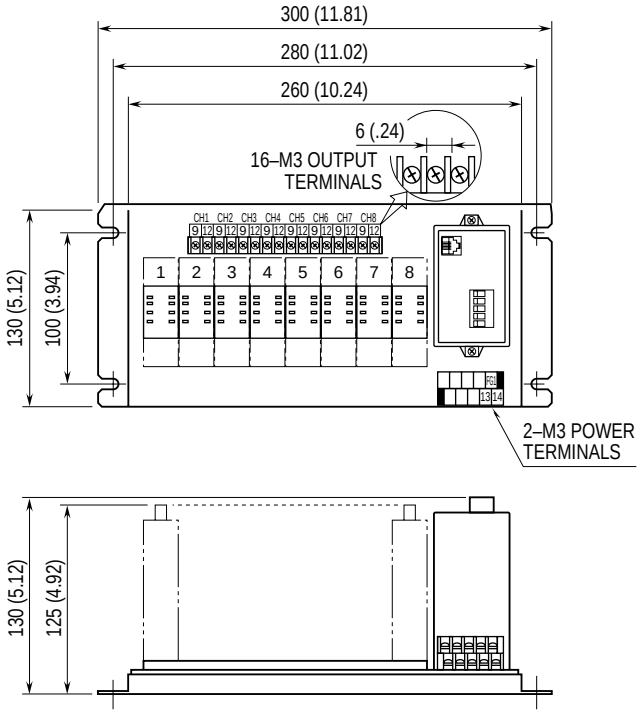
*165 (6.50) required for pneumatic tubing for M2PV.

4.2 M2BD-❑2

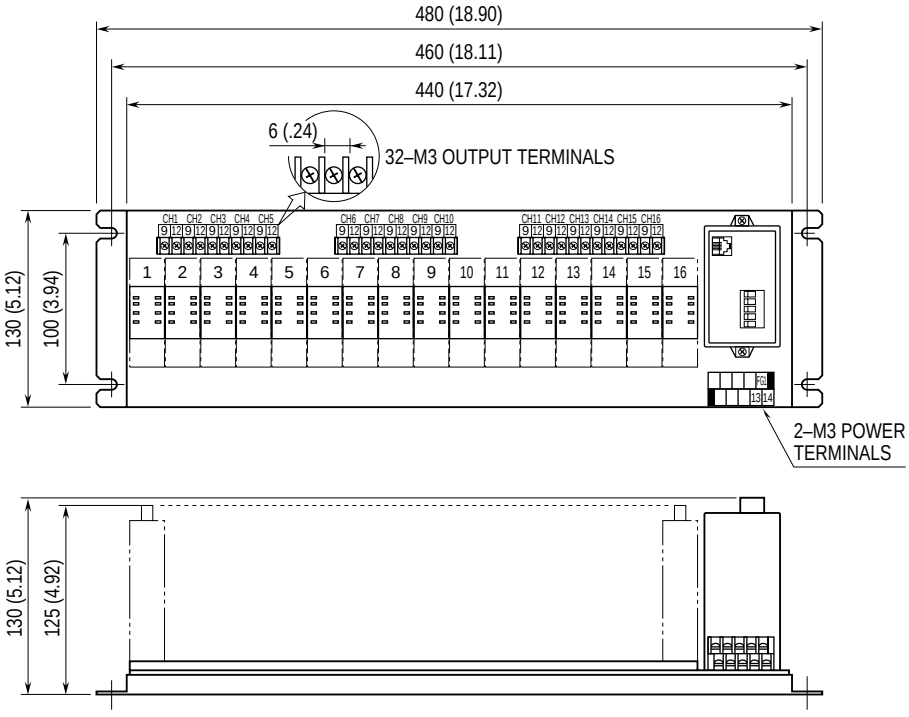
4.2.1 M2BD-042



4.2.2 M2BD-082

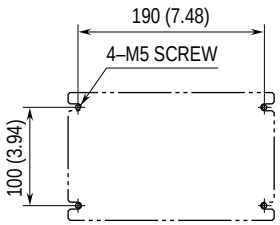


4.2.3 M2BD-162

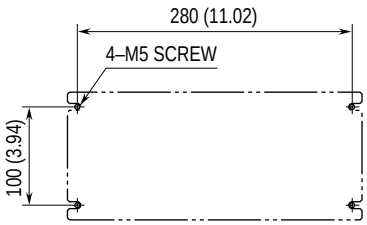


4.3 MOUNTING REQUIREMENTS mm (inch)

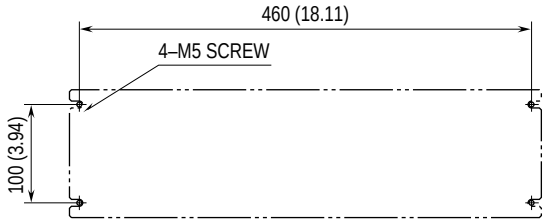
4.3.1 M2BD-04❑



4.3.2 M2BD-08❑



4.3.3 M2BD-16❑



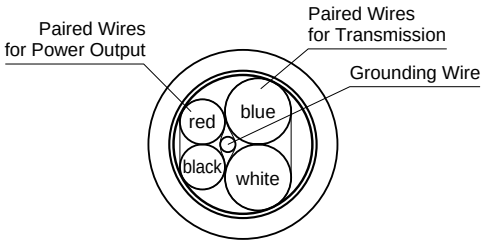
5. CONNECTING DATA LINK WIRES

The following explanations apply to the wires connecting the M2BD to the Master Unit.

5.1 COMMUNICATION WIRE

The following types of wire are recommended for connecting the M2BD to the Master Unit.

OMRON	DCA1-5C10 (THIN)
	DCA2-5C10 (THICK)
KURAMO ELECTRIC	KND-SB (THIN)
	KND-SB (THICK)
SHOWA ELECTRIC WIRE & CABLE	TDN24U-100G (THIN)
	TDN18U-100G (THICK)
SUMITOMO WIRING SYSTEMS	DN-24P1+20P1 SBS (THIN)
	DN-18P1+15P1 SBS (THICK)



5.2 POINTS OF CAUTION IN HANDLING WIRES

DO NOT apply extraordinary forces to the wires as explained in the following:

(1) DO NOT SQUEEZE the wires with a sharp-edged tool.

(2) DO NOT TWIST the wires extraordinarily.

(3) DO NOT PULL the wires extraordinarily tight.

(4) DO NOT TRAMPLE on the wires.

(5) DO NOT PUT objects onto the wires.

(6) DO NOT DAMAGE the insulation tube of wires.

5.3 WIRE IDENTIFICATION

The following table defines wire insulation colors and designations. The M2BD terminal block is labeled also in the same colors so that the correct assignment can be confirmed.

COLOR	DESIG.	DESCRIPTION
black	V –	Power (–)
blue	CAN_L	Signal Low
bare	Drain	Shield
white	CAN_H	Signal High
red	V +	Power (+)

6. CONNECTING WIRES

This section explains points of caution when wiring I/O modules and examples of wiring diagrams.

6.1 POINTS OF CAUTION

Appropriate precautions are required such as follows for protecting the system from external noise interference:

(1) Separate analog I/O and communication wires from others in order to prevent surge or induction noises.

(2) Separate power input wires (AC) from those for driving motors.

(3) Do not install these wires next to main supply circuits or high voltage cables.

Never bind them to these circuits.

(4) Ground the shield of communication wires at one point.

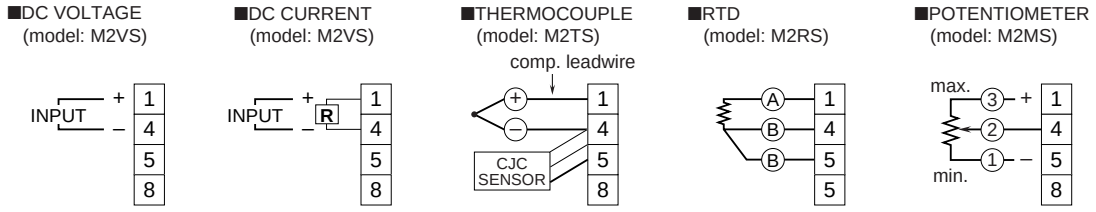
Consideration about locations of the ground may be necessary according to external noise interference.

6.2 WIRING EXAMPLES OF M2BD-❑1

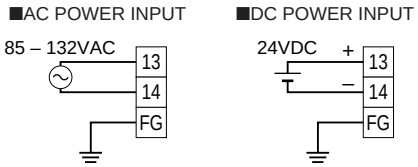
(1) Input Signal

The terminal No. marked on the Input Terminal Block are the same as those marked on individual Mini-M series I/O Signal Conditioners. Refer to data sheets for the I/O modules when wiring each module.

Typical wiring diagrams are shown in the following:



(2) Power Input

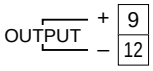


6.3 WIRING EXAMPLES OF M2BD-❑2

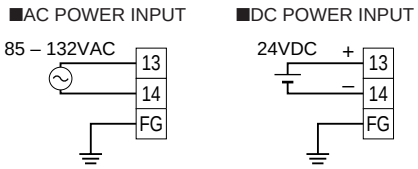
(1) Output Signal

The terminal No. marked on the Output Terminal Block are the same as those marked on individual Mini-M series I/O Signal Conditioners. Refer to data sheets for the I/O modules when wiring each module.

Output range may be different between modules even though all output signals are connected to the 9 (+) – 12 (–) terminals.



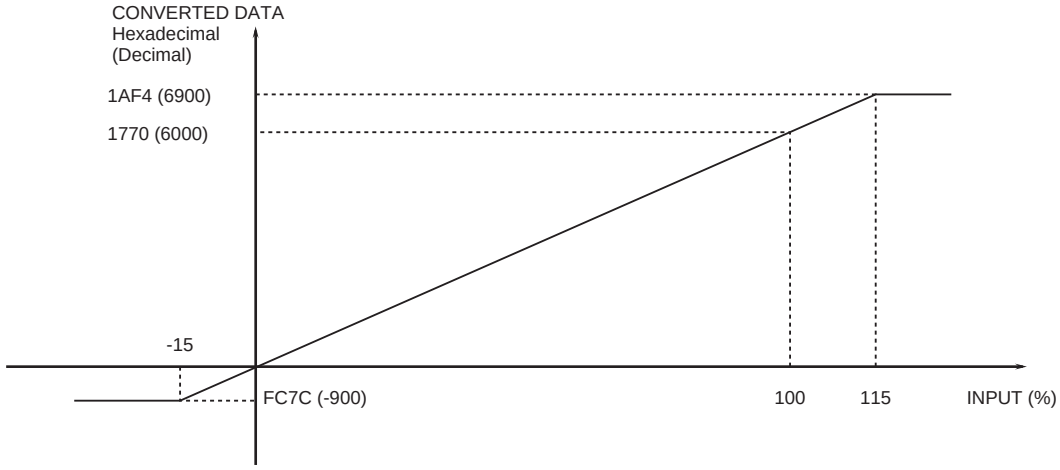
(2) Power Input



7. DATA CONVERSION

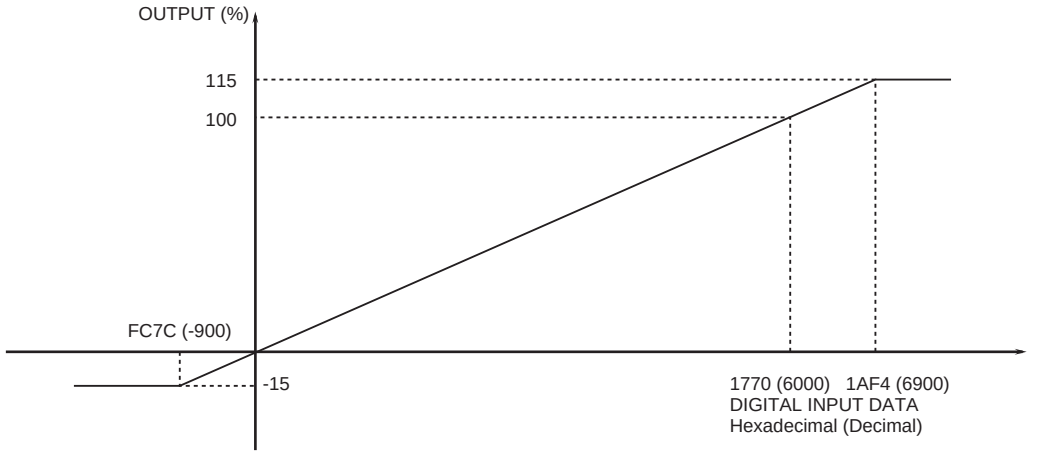
(1) M2BD-❑1

Analog signal range 0 – 100% is converted into hexadecimal and provided to the Master Unit.



(2) M2BD-❑2

Hexadecimal from the Master Unit is converted into analog signal range 0 – 100%.



8. DEVICE PROFILE & OBJECT IMPLEMENTATION

8.1. SLAVE DEVICE PROFILE

General Device Data	Conform to DeviceNet Specification	Volume I - Release 2.0 Volume II - Release 2.0	
	Vendor Name	M-SYSTEM CO., LTD.	Vendor ID = 184
	Device Profile Name	Slave: Generic	Profile No. = 0
	Device Type	0	
Physical Conformance Data	Network Power Consumption	60mA	
	Connector Style	Open-Pluggable	
	Isolated Physical Layer	Yes	
	LEDs Supported	Module Network	
	MAC ID Setting	DIP Switch	
	Default MAC ID	0	
	Communication Rate Setting	DIP Switch	
	Communication Rates Supported	125k bit/s, 250k bit/s, 500k bit/s	
Communication Data	Predefined Master/Slave Connection Set	Group Only 2 Server	
	Dynamic Connections Supported (UCMM)	No	
	Fragmented Explicit Message Implemented	Yes	

8.2. OBJECT IMPLEMENTATION

(1) Identity Object (01H)

Object Class	Attributes	None Supported
	Services	None Supported

Object Instance	Attributes	ID	Description	Get	Set	Value Limit
		1	Vendor	Yes	No	184
		2	Device type	Yes	No	0
		3	Product code	Yes	No	*
		4	Revision	Yes	No	1.5
		5	Status (bits supported)	Yes	No	bit 0, bit 10
		6	Serial number	Yes	No	Each unit
		7	Product name	Yes	No	*
		8	State	No	No	
		9	Configuration consistency value	No	No	
		10	Heartbeat interval	No	No	
	Services		DiviceNet Services	Parameter Options		
		05H	Reset	No		
		0EH	Get_Attribute_Single	No		

*Depending upon model numbers as in the table below.

Model	Product Code	Product Name
M2BD-161-❑	1	M2BD-161
M2BD-162-❑	2	M2BD-162
M2BD-081-❑	3	M2BD-081
M2BD-082-❑	4	M2BD-082
M2BD-041-❑	5	M2BD-041
M2BD-042-❑	6	M2BD-042

(2) Message Router Object (02H)

Object Class	Attributes	None Supported
	Services	None Supported
Object Instance	Attributes	None Supported
	Services	None Supported
Vendor Specific Additions		None

(3) DeviceNet Object (03H)

Object Class	Attibutes	ID	Description	Get	Set	Value Limit
		1	Revision	Yes	No	02H
	Services		DiviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		

Object Instance	Attributes	ID	Description	Get	Set	Value Limit
		1	MAC ID	Yes	No	
		2	Baud rate	Yes	No	
		3	BOI	Yes	No	00H
		4	Bus-off counter	Yes	No	
		5	Allocation information	Yes	No	
		6	MAC ID switch changed	No	No	
		7	Baud rate switch changed	No	No	
		8	MAC ID switch value	No	No	
		9	Baud rate switch value	No	No	
	Services		DiviceNet Services	Paraqmeter Options		
		0EH	Get_Attribute_Single	No		
		4BH	Allocate M/S connection set	No		
		4CH	Release M/S connection set	No		

(4) Assembly Object (04H)

Object Class	Attributes	None Supported
	Services	None Supported

Object Instance 1	Section		Information	Max Instance		
	Instance Type	Static I/O		1		
	Attributes	ID	Description	Get	Set	Value Limit
		1	Numbers of memebers in list	No	No	
		2	Member list	No	No	
		3	Data	Yes	Yes	
	Services		DiviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		

(5) Connection Object (05H)

Object Class	Attributes	None Supported
	Services	None Supported
	Total Active Connections Possible	1

Object Instance 1	Section	Information			Max Instance	
	Instance Type	Explicit Message			1	
	Production Trigger	Cyclic				
	Transport Type	Server				
	Transport Class	3				
	Attributes	ID	Description	Get	Set	Value Limit
		1	State	Yes	No	
		2	Instance type	Yes	No	00H
		3	Transport class trigger	Yes	No	83H
		4	Produced connection ID	Yes	No	
		5	Consumed connection ID	Yes	No	
		6	Initial comm. characteristics	Yes	No	21H
		7	Produced connection size	Yes	No	FE00H
		8	Consumed connection size	Yes	No	FE00H
		9	Expected packet rate	Yes	Yes	
		12	Watchdog time-out action	Yes	Yes	One of 01, 03
		13	Produced connection path length	Yes	No	0000
		14	Produced connection path	Yes	No	
		15	Consumed connection path length	Yes	No	0000
		16	Consumed connecion path	Yes	No	
	Services		DiviceNet Services	Parameter Options		
		05H	Reset	No		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		
Object Instance 2	Section	Information			Max Instance	
	Instance Type	Polled I/O			1	
	Production Trigger	Cyclic				
	Transport Type	Server				
	Transport Class	2				
	Attributes	ID	Description	Get	Set	Value Limit
		1	State	Yes	No	
		2	Instance type	Yes	No	01H
		3	Transport class trigger	Yes	No	82H
		4	Produced connection ID	Yes	No	
		5	Consumed connection ID	Yes	No	
		6	Initial comm. characteristics	Yes	No	01H
		7	Produced connection size	Yes	No	**
		8	Consumed connection size	Yes	No	**
		9	Expected packet rate	Yes	Yes	
		12	Watchdog time-out action	Yes	No	00
		13	Produced connection path length	Yes	No	0000 (OUT) 0600 (IN)
		14	Produced connection path	Yes	No	No data (OUT) 20_04_24_01_30_03 (IN)
		15	Consumed connection path length	Yes	No	0000 (IN) 0600 (OUT)
		16	Consumed connecion path	Yes	No	No data (IN) 20_04_24_01_30_03 (OUT)
		17	Production inhibit time	Yes	No	00
	Services		DiviceNet Services	Parameter Options		
		05H	Reset	No		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		

**Depending upon model numbers as in the table below. The actual data is composed of two bites, of which the MSB (00H) and LSB (table below) are inverted.

Model	Produced Connection Size	Consumed Connection Size
M2BD-161-❑	20H	00H
M2BD-081-❑	10H	00H
M2BD-041-❑	08H	00H
M2BD-162-❑	00H	20H
M2BD-082-❑	00H	10H
M2BD-042-❑	00H	08H

9. TROUBLESHOOTING

Basic troubleshooting methods using MS and NS indicator LEDs are explained in this section.

For problems concerning the PLC CPU and Master Unit, consult users manuals for these units.

9.1 MS & NS INDICATORS

LED	STATE	TO INDICATE
MS	Green	Operating in a normal condition
	Flashing Green	Standby (needs commissioning)
	Red	Critical failure
	Flashing Red	Minor failure
	OFF	No power supplied
NS	Green	Link on-line and connections in the established state
	Flashing Green	Link on-line but no connections in the established state
	Red	Critical link failure
	Flashing Red	Minor link failure
	OFF	No power supplied

9.2 TROUBLESHOOTING

MS LED	NS LED	STATUS		NOTES & TROUBLESHOOTING
Green ON	Green ON	Communicating	Communicating	The M2BD is in communication with Master Unit.
Green ON	OFF	Node address is already used. Checking.	Waiting for the Master Unit to check node address.	
Green ON	Green flash	Standby for commissioning.	Standby for the Master Unit to establish connection.	
Red ON	OFF	Watch-dog timer error	Watch-dog timer error	The M2BD error.
Red flash	OFF	Invalid switch setting	Invalid DIP SW setting.	Check DIP SW setting and restart the M2BD.
Green ON	Red ON	Node address is already used.	The same node address is used for the Master Unit.	Change the node address and restart the M2BD.
Green ON	Red ON	Bussoff	Bussoff (abnormal data transmission)	Check the following points and restart the M2BD. •Are the baud rate for both Master and Slave the same? •Is the wire length (main and sub) appropriate? •No breakdown or loosening of wires? •Are the terminators only at the both ends of transmission line? •No excessive noise?
Green ON	Red flashing	Timeout	——	Check the following points and restart the M2BD. •Are the baud rate for both Master and Slave the same? •Is the wire length (main and sub) appropriate? •No breakdown or loosening of wires? •Are the terminators only at the both ends of transmission line? •No excessive noise?

9.3 ANALOG ZERO & SPAN ADJUSTMENTS FOR I/O SIGNAL CONDITIONERS

I/O types and ranges can be field-selectable for certain types of Mini-M series I/O Signal Conditioners, and zero and span adjustments are available for most types. Refer to data sheets for the I/O modules for detailed information.

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.

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