## Remote I/O R3 Series

FL-net INTERFACE MODULE
(OPCN-2)

Functions & Features
• FL-net (OPCN-2), Ethernet based, controller level network, compatible remote I/O
• 10 Mbps/100 Mbps cyclic transmission for the maximum of 4k bits + 256 words (1 word = 16 bits) allows data shared among the devices connected to the bus
• FL-net bus extended to max. 500 meters, up to 2.5 kilometers with a repeater
• I/O data can be assigned to any bits or words in the common memory
• No need of ladder programming
• Request/response type data access of message transmission is also possible
• Any other network module can be assigned to the dual redundant internal bus
• Supports multiple protocol of FL-net plus DeviceNet, CC-Link, and others
• Masterless configuration allows the FL-net I/Os function as local multiplex transmission system

27.5 (1.08)
139 (5.47)
109 (4.29)
mm (inch)

CE
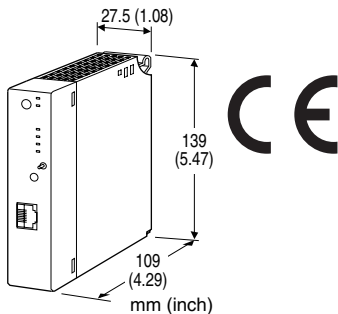
MODEL: R3-NFL1[1]

ORDERING INFORMATION
• Code number: R3-NFL1-[1]
Specify a code from below for [1].
 (e.g. R3-NFL1/CE/Q)
• Specify the specification for option code /Q
 (e.g. /C01)

[1] OPTIONS (multiple selections)
Standards & Approvals
blank: Without CE
/CE: CE marking
Other Options
blank: none
/Q: Option other than the above (specify the specification)

SPECIFICATIONS OF OPTION: Q
COATING (For the detail, refer to M-System's web site.)
/C01: Silicone coating
/C02: Polyurethane coating
/C03: Rubber coating

FUNCTIONS & FEATURES
■ The R3-NFL1 is used to access field signals at the R3 I/O modules via FL-net.
No ladder programming is required to assign these I/O signals.
■ Analog and discrete input signals are transmitted cyclically.
Any PC or PLC compatible with FL-net, up to 254 nodes, can retrieve the updated data by accessing the common memory without interfering with the communication traffic.
■ Analog and discrete input signals cyclically transmitted from other devices can be output at the R3 output modules. The FL-net Configuration Builder software (model: R3-NFLBLD) is used to assign these I/O signals on the common memory in the bit or word units.
■ The R3-NFL1, constantly scanning its I/O modules via the internal bus, has the updated data always ready for a request from the FL-net. High speed response without any loss time is possible.
■ Request/Response type message communication, accessing I/O data only when necessary, is also possible.
■ Dual redundant network configuration using two network modules is available.
Two different network protocols, e.g. FL-net and Device-Net or FL-net and CC-Link, can be used to access one field signal.
■ Masterless configuration allows two FL-net nodes function as local multiplex transmission system.

CAUTION !
• FL-net standard requires a dedicated Ethernet bus for the FL-net compatible devices. Connecting the R3-NFL1 to a general-purpose LAN, or connecting a general-purpose TCP/IP device to FL-net is Not allowed.
• FL-net uses UDP/IP protocol for transmission. ISDN, ADSL or similar types of LAN are Not to be used.

GENERAL SPECIFICATIONS
Connection
  Network: RJ-45 connector
  Internal bus: Via the Installation Base (model: R3-BSx)
  Internal power: Via the Installation Base (model: R3-BSx)
  RUN contact output: Euro type connector terminal
RUN/CFG selector: Toggle switch; RUN or Configuration
Isolation: Ethernet to internal bus or internal power to RUN

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contact output

Main/Sub setting: Set with the side DIP switch

Indicator LEDs

PWR: Green light turns on when the CPU and the internal bus function normally.

ERR: Red light turns on in an abnormality of the system.

LNK: Red light turns on while the R3-NFL1 is participating FL-net (normal communication)

HER: Red light turns on in an abnormality of the R3-NFL1 module.

PER: Red light blinks on with the parameter setting error.

CFG: Red light blinks in high speed at the startup; blinks in low speed while the builder software is used.

TX: Green light turns on while transmitting.

RX: Amber light turns on while receiving.

RUN contact: Relay turns on when the CPU and the internal bus function normally.

■ **RUN Contact output**

Rated load: 100 V AC @ 0.5A (cos ø = 1)

30 V DC @ 0.5 A (resistive load)

(≤ 50 V AC, ≤ 75 V DC for CE conformity.)

Maximum switching voltage: 250 V AC or 220 V DC

Maximum switching power: 62.5 VA or 60 W

Minimum load: 10 mV DC @ 1 mA

Mechanical life: 5×10^7 cycles.

FL-net SPECIFICATIONS

Physical layer standard: IEEE 802.3u

Data link layer: 10BASE-T / 100BASE-TX

Baud rate: 10 / 100 Mbps, Auto Negotiation

Protocol: FL-net (OPCN-2) (UDP/IP)

Transmission media: 10BASE-T (STP cable, category 5) 100BASE-TX (STP cable, category 5e)

Max. segment length: 100 meters

Max. number of nodes: 254

IP address: FL-net Configuration Builder is used to set up the IP address and the network address.

Factory setting:

192.168.250.1 (IP address)

255.255.255.0 (network address)

Max. cyclic data size:

8 k bits (area 1) + 8 k words (area 2) / system

4 k bits (area 1) + 256 words (area 2) / node

Max. message data size: 1024 bytes (per transmission cycle)

Performance (2k bits + 2k words / node, 32 nodes in total)

Token cycle time: 50 milliseconds (1.56 milliseconds/ node in average)

Message transmission time: 500 milliseconds (1 : 1 unidirectional message)

INSTALLATION

Current consumption: 130 mA

Operating temperature: -10 to +55°C (14 to 131°F)

Operating humidity: 30 to 90 %RH (non-condensing)

Atmosphere: No corrosive gas or heavy dust

Mounting: Installation Base (model: R3-BSx)

Weight: 200 g (0.44 lb)

PERFORMANCE

Insulation resistance: ≥ 100 MΩ with 500 V DC

Dielectric strength: 1500 V AC @ 1 minute (Ethernet to internal bus or internal power to RUN contact output)

2000 V AC @ 1 minute (power input to FG; isolated on the power supply module)

STANDARDS & APPROVALS

CE conformity:

EMC Directive (2004/108/EC)

EMI EN 61000-6-4: 2007/A1: 2011

EMS EN 61000-6-2: 2005

FL-net DESCRIPTIONS

■ CYCLIC TRANSMISSION

• Transmitting discrete I/O status, analog I/O values and modules' information on hardware commissioning, hardware errors, data errors and signal source node errors.

• Supplying word data transmitted from another devices to local output modules. The R3-NFL1 operation when this device exits the FL-net is selectable: Hold output, Clear output, Switch to the sub system's control.

• Allotting the cyclic transmission output data of multiple devices bit by bit to local output modules.

■ MESSAGE TRANSMISSION

The module supports the FL-net defined functions listed in the following table. Only the server function is supported. Server function allows the module to build a response frame to a request message.

Client function allows the module to transmit a request message and to receive its response frame.

MESSAGE TYPE	SERVER	CLIENT
Byte block read	No	No
Byte block write	No	No
Word block read	Yes	No
Word block write	Yes	No
Network parameter read	Yes	No
Network parameter write	No	No
Stop command	Yes	No
Start command	Yes	No
Profile read	Yes	No
Transparent mode	No	No
Log data read	Yes	No
Log data clear	Yes	No
Message echo back	Yes	No

APPLICATION SOFTWARE CD

■ FL-net CONFIGURATION BUILDER SOFTWARE
(model: R3-NFLBLD)

• The R3-NFLBLD is used to configure the common memory of the R3-NFL1 module for FL-net.
• Configuration setup on the PC is dowloaded to the R3-NFL1 via Ethernet.
• Configuration setup on the R3-NFL1 can be uploaded to the PC and saved as a file.
• Instructions included in the software CD:
 R3-NFL1 instruction manual
 R3-NFLBLD users manual

PC REQUIREMENTS (provided by the user)

The following PC environment is required to run the R3-NFLBLD program.

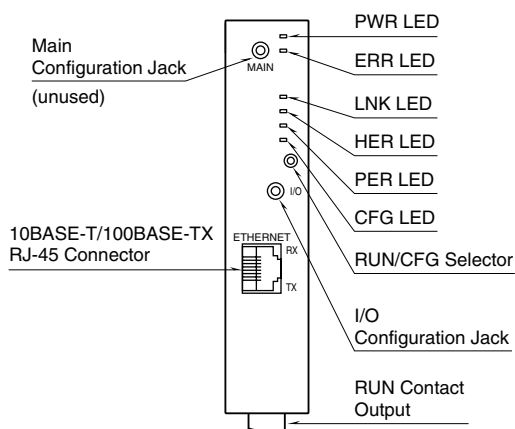**Operating system**: Microsoft Windows XP or Windows 7 (32bit/64bit)

Screen area: 1024 by 768 pixels
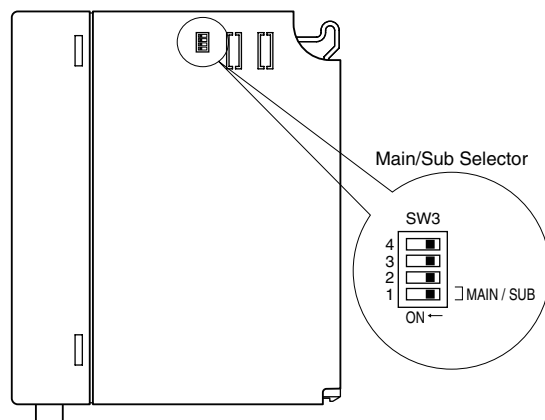
CD-ROM drive: Required to install the program

LAN card: Required to connect to Ethernet

EXTERNAL VIEW

■ FRONT VIEW

■ SIDE VIEW

Main Configuration Jack (unused)

PWR LED
ERR LED
LNK LED
HER LED
PER LED
CFG LED
RUN/CFG Selector

10BASE-T/100BASE-TX RJ-45 Connector

I/O Configuration Jack

RUN Contact Output

Main/Sub Selector

SW3
4
3
2
1
MAIN / SUB
ON ←

TRANSMISSION DATA DESCRIPTIONS

I/O data of each I/O module are assigned to specific areas of the common memory using the FL-net Configuration Builder software (model: R3-NFLBLD) by each channel, in the word / bit units.

For example, suppose as follows:

    Common memory area 1 top address : 0x0000
    Common memory area 1 data size   : 8
    Common memory area 2 top address : 0x0000
    Common memory area 2 data size   : 4

    Module (slot) 1 : R3-SV4
    Module (slot) 2 : R3-DA16
   Module (slot) 3 : R3-YV4
    Module (slot) 4 : R3-DC16

■ COMMON MEMORY AREA 1

The following shows the data transmitted to the common memory area 1 from the network module.

• R3-NFLBLD Setting Example

Address	I/O module/ch	Description	
0x0000 <==	AI01.01	Transmitting	the R3-SV4 ch.1 data to the common memory area 1, address 0x0000
0x0001 <==	AI01.02	Transmitting	the R3-SV4 ch.2 data to the common memory area 1, address 0x0001
0x0002 <==	AI01.03	Transmitting	the R3-SV4 ch.3 data to the common memory area 1, address 0x0002
0x0003 <==	AI01.04	Transmitting	the R3-SV4 ch.4 data to the common memory area 1, address 0x0003
0x0004 <==	DI00.01 ... 16	Transmitting	the module status to the common memory area 1, address 0x0004
0x0005 <==	DI00.17 ... 32	Transmitting	the module error to the common memory area 1, address 0x0005
0x0006 <==	DI00.33 ... 48	Transmitting	the data error to the common memory area 1, address 0x0006
0x0007 <==	DI00.49 ... 64	Transmitting	the source node error to the common memory area 1, address 0x0007

• **Data Frame**
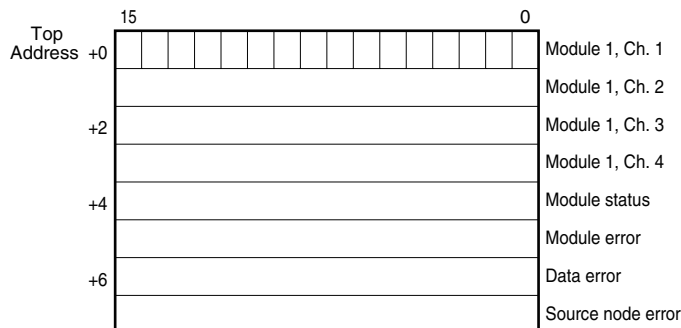
• Module Status indicates whether individual I/O module are mounted or not. The bit corresponding to the mounted slots turns to "1," and the unmounted slots to "0."

• Error Status indicates error status for each module as described below. The bit corresponding to such modules turns to "1."
    -TSx, -RSx, -US4: Input burnout
    -DA16A: Power input in error or disconnected
    -YSx: Output current error (e.g. load unconnected)

• Data Error Status indicates overrange (-US4: out of -10% to +110%; the other types: out of -15% to +115%) status for each module. The bit corresponding to such modules turns to "1."
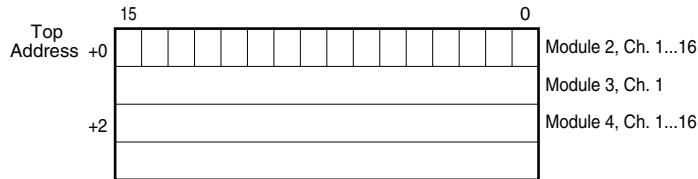
■ COMMON MEMORY AREA 2

The following shows the data transmitted to the common memory area 2 from the network module.

• R3-NFLBLD Setting Example

Address	I/O module/ch	Description
0x0000 <==	DI02.01 ... 16	Transmitting the R3-DA16 ch.1 through ch.16 data to the common memory area 2, address 0x0000
0x0001 <==	AO03.01	Transmitting the R3-YV4 ch.1 data to the common memory area 2, address 0x0001
0x0002 <==	DO04.01 ... 16	Transmitting the R3-DC16 ch.1 through ch.16 data to the common memory area 2, address 0x0002

• Data Frame

	15	0	
Top Address +0			Module 2, Ch. 1...16
			Module 3, Ch. 1
+2			Module 4, Ch. 1...16

■ OUTPUT MODULE

The output data at designated addresses of the common memory area are transmitted to the R3 series output modules.

• R3-NFLBLD Setting Example

I/O module/ch	Address	Description
< Module 3 >		
AO03.01 <==	1-0x0000	Transmitting the data at the common memory area 1, address 0x0000 (R3-SV4 ch.1) to the R3-YV4 ch.1
AO03.02 <==	1-0x0001	Transmitting the data at the common memory area 1, address 0x0001 (R3-SV4 ch.2) to the R3-YV4 ch.2
AO03.03 <==	1-0x0002	Transmitting the data at the common memory area 1, address 0x0002 (R3-SV4 ch.3) to the R3-YV4 ch.3
< Module 4 >		
DO04.01 <==	2-0x0000-16	Transmitting the data at the common memory area 2, address 0x0000, 16th bit (R3-DA16 ch.16) to the R3-DC16 ch.1

I/O DATA DESCRIPTIONS

■ MODULE STATUS, ERROR STATUS, DATA ERROR STATUS

Shows each module's availability and error status.

15													0

Module 1
Module 2
Module 3
:
Module 16
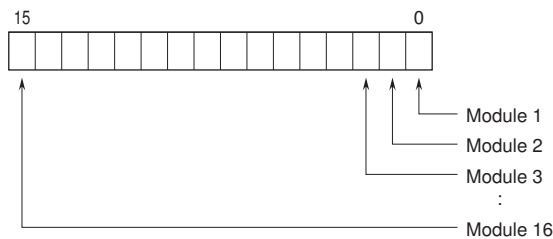
■ ANALOG DATA (models: R3-SV4, YV4, DS4, YS4, US4, etc.)

16-bit binary data.
Basically, 0 to 100% of the selected I/O range is converted into 0 to 10000 (binary). Negative percentage is represented in 2's complements.

15															0

■ TEMPERATURE DATA (models: R3-RS4, TS4, US4, etc.)

16-bit binary data.
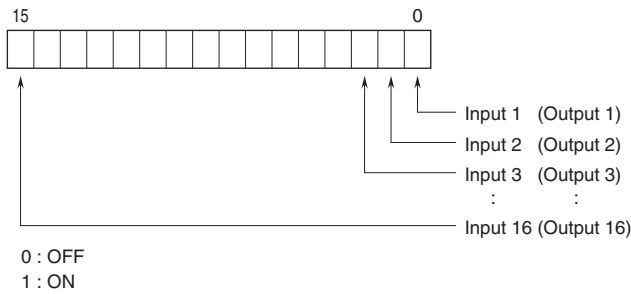With °C temperature unit, raw data is multiplied by 10. For example, 25.5°C is converted into 255.
With °F temperature unit, the integer section of raw data is directly converted into the data.
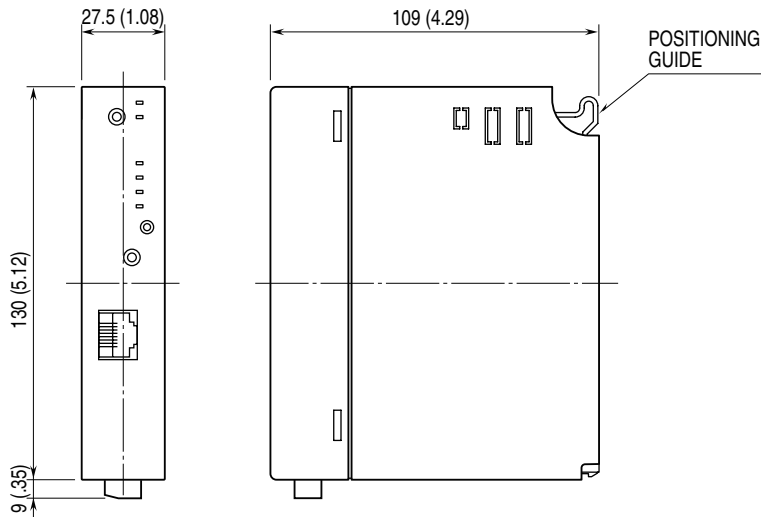For example, 135.4°F is converted into 135.
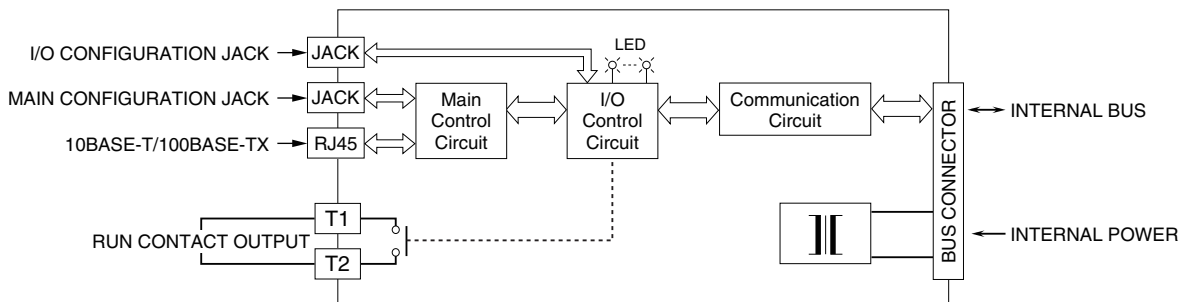Minus temperature is converted into negative values, represented in 2's complements.

15   0

■ 16-POINT DISCRETE DATA (models: R3-DA16, DC16, etc.)

15   0

Input 1   (Output 1)
Input 2   (Output 2)
Input 3   (Output 3)
:   :
Input 16 (Output 16)

0 : OFF
1 : ON

DIMENSIONS unit: mm (inch)

27.5 (1.08)   109 (4.29)   POSITIONING GUIDE

130 (5.12)

9 (.35)

SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

I/O CONFIGURATION JACK → JACK
MAIN CONFIGURATION JACK → JACK
10BASE-T/100BASE-TX → RJ45

LED

Main Control Circuit   I/O Control Circuit   Communication Circuit   BUS CONNECTOR → INTERNAL BUS

RUN CONTACT OUTPUT   T1
T2

INTERNAL POWER

SYSTEM CONFIGURATION EXAMPLES

Yellow Cable
(10BASE-5)

Transceiver (Yellow Tap) — Transceiver — Transceiver

Term. Resistor (50 ohms)

AUI Cable

Ethernet Hub

STP Cable

STP Cable (10BASE-T)

Term. Resistor (50 ohms)

FL-net Compatible PLC

FL-net (OPCN-2) Network Module (model: R3-NFL1)

FL-net (OPCN-2) Network Module (model: R3-NFL1)
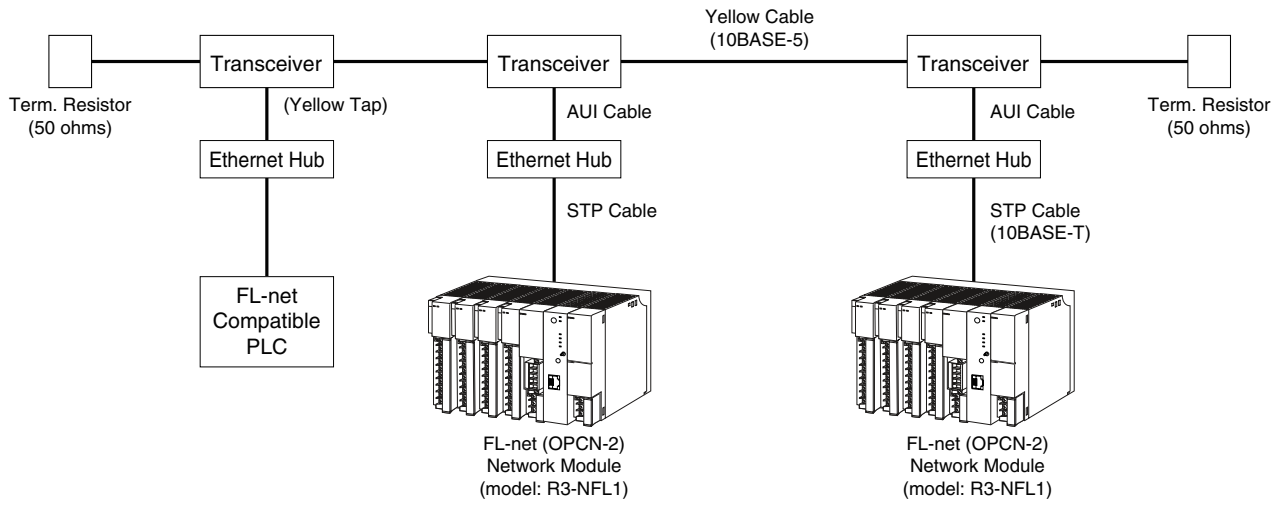
⚠ Specifications are subject to change without notice.