

OMRON

Model EJ1N-HFU-ETN

INSTRUCTION SHEET

Thank you for purchasing an OMRON product. Read this thoroughly and familiarize yourself with the functions and characteristics of the product before using it. Keep this instruction sheet for future reference.



OMRON Corporation

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OMRON

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Note: Specification is subject to change without notice

■ General Precautions

The user must operate the product according to the performance specifications described in this instruction sheet and in the EJ1 Modular Temperature Controller Data Sheet.

Before using the product under conditions which are not described in the EJ1 Modular Temperature Controller Data Sheet or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

- An EJ1N-HFU-ETN unit is a general purpose product acting as PROFINET IO Device. It is a system component and is used in conjunction with other items of industrial equipment such as PLCs, EJ1 temperature controllers and other Modbus RTU nodes.
- A detailed system analysis and job safety analysis should be performed by the system designer or system integrator before including the EJ1N-HFU-ETN in any new or existing system. Consult your OMRON representative for application specific system integration information if required.

■ Safety Precautions

Definition of Precautionary Information

- WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
- Caution** Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury, or property damage.

■ Warnings and Cautions

- WARNING** Do not attempt to take the unit apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.
- WARNING** The unit cannot be mounted on a CJ-series PLC.
- WARNING** Do not touch the conductive parts such as the internal PCB or connector while power is being supplied. Doing so may result in electrical shock.
- WARNING** Do not attempt to disassemble, repair, or modify any unit. Any attempt to do so may result in malfunction, fire, or electric shock.
- WARNING** Wiring, maintenance or inspection must be performed by authorized personnel. Not doing so may result in electrical shock or fire.
- WARNING** Turn OFF the power supply before performing wiring, maintenance or inspection. Not doing so may result in electrical shock.
- WARNING** Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents.

■ Operating Environment Precautions

- Caution** Use the unit indoors. Do not operate the unit in the following locations (doing so may result in malfunction, electric shock or burning):
 - Locations subject to direct sunlight
 - Locations subject to temperatures or humidity outside the range specified in the specifications
 - Locations subject to condensation as the result of severe changes in temperature
 - Locations subject to corrosive or flammable gases
 - Locations subject to dust (especially iron dust) or salts
 - Locations subject to exposure to water, oil, or chemicals
 - Locations subject to shock or vibration

- Caution** Provide proper shielding when installing systems in the following locations (doing so may result in malfunction):
 - Locations subject to static electricity or other forms of noise
 - Locations subject to strong electromagnetic fields
 - Locations subject to possible exposure to radioactivity
 - Locations close to power supplies

- Caution** The operating environment of the unit can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the system. Make sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

■ Application Precautions

- WARNING** Failure to abide by the following precautions could lead to serious or possibly fatal injury. Always read these precautions.
 - Always mount the EJ1N-HFU-ETN unit at the left side of an EJ1 system or EJ1C-EDU End Unit.
 - Check the configuration of all connected Modbus RTU nodes regarding node address, baud rate and parity setting. Not doing so may result in unexpected operation.
 - When replacing a connected Modbus RTU node, be sure that the configuration of the node being replaced is restored to the replacement.
 - Restoring parameters into a Modbus RTU node also restores the Modbus node address. Always check the node address and other Modbus related settings after a restore.
 - Do not remove the network cable during operation. Removing the network cable results in PROFINET communication failures.
 - A PROFINET communication failure causes the unit to stop updating registers in the configured Modbus RTU nodes. Make sure that the safety mechanisms in Modbus RTU nodes are configured to act in this situation. Not doing so results in lost control over these Modbus RTU nodes. These safety mechanisms are device specific. Please consult the device manufacturer to configure these safety mechanisms properly.
 - Check any user program in the system that acts as a PROFINET IO Controller before actually running it. Not checking the program may result in unexpected operation.

- Caution** Failure to abide by the following precautions could lead to faulty operation of the unit, or could damage the unit. Always read these precautions.
 - Be sure that the cable connectors are properly locked into place. Incorrect insertion of connectors may result in malfunction.
 - Always ground the unit via a conductive DIN rail using the following steps:
 - Connect the DIN rail to functional ground.
 - Mount a PFP-M DIN rail end stop at both sides of the assembly: the EJ1N-HFU-ETN side and the EJ1C-EDU side.
 - Check that the left DIN rail end stop properly connects to the grounding plate at the back side of the EJ1N-HFU-ETN.
 - Do not allow metal clippings to enter the unit during wiring or installing.
 - Follow the network configuration and wiring instructions provided in the "PROFINET Installation Guideline for Cable and Assembly" (PNO Order No. 8.072).
 - Wire correctly using shielded CAT5E Ethernet cables. Incorrect wiring may result in communication failures.
 - Limit the network cable length to maximum 100m.
 - Use properly configured industrial Ethernet switches to connect a PROFINET IO Controller. Configure the switches to support IGMP if the Ethernet segment is shared between Ethernet/IP and PROFINET.
 - Separate the PROFINET network segment from the office network to avoid PROFINET communication failures.
 - Be sure that the unit is mounted upright. Improper mounting may result in malfunction.
 - Check the settings of the configured Modbus RTU nodes for proper behaviour before actually operating the nodes remotely via the PROFINET network.
 - Confirm that no adverse effect will occur at the moment the PROFINET IO Controller stops communicating with the unit or at the moment the PROFINET IO Controller has not yet started communicating to the unit.
 - Confirm that no adverse effect will occur in a Modbus RTU node before force-setting/force-resetting any bit in the system that acts as a PROFINET IO Controller.

■ Handling, Storage and Disposal

- Before touching the unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- When transporting or storing the unit keep the product within the specified storage temperature range.
- Never dispose electrical components by incineration. Contact your state environmental agency for details on disposal of electrical components and packaging in your area.

■ Compliance with EC Directives

This product complies with EC Directives when grounded via the DIN rail

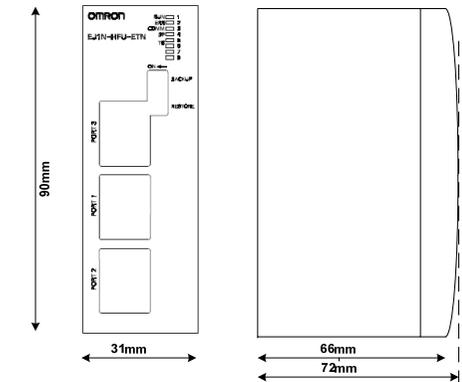
■ References

Please be sure to read the related user manuals to use the EJ1N-HFU-ETN unit safely and properly. Be sure you are using the most current version of the manual.

Name	Cat No.
EJ1 Modular Temperature Controllers User's Manual	H142
EJ1 Modular Temperature Controller Data Sheet	H144
CJ1W-PNT21 PROFINET IO Controller Operation Manual	W12E
PROFINET Installation Guideline for Cable and Assembly	PNO Order No. 8.072

■ External Dimensions

External dimensions of the unit, shown in millimetres:



■ General Specifications

Item	Specifications
PROFINET	IO Device
Conformance Class	A
Supported RT Class	1
Minimum Update Rate	8ms
Number of Modbus RTU nodes	31
Ambient operating temperature	-10 °C to 55 °C
Ambient operating humidity	25% to 85%
Storage temperature	-20 °C to 65 °C
Weight	170g

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used. Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

See also product catalogs for Warranty and Limitations of Liability.

Unit Description

The EJ1N-HFU-ETN is a unit that can be connected to EJ1 modular temperature controllers. Indirectly the EJ1N-HFU-ETN can communicate to other Omron temperature controllers and other Modbus RTU nodes via port B of the EJ1C-EDU End Unit. The EJ1N-HFU-ETN supports up to 31 connected Modbus RTU nodes. The EJ1N-HFU-ETN allows controlling, monitoring and parameterization of Modbus RTU nodes via a PROFINET network. The application in the system that acts as a PROFINET IO Controller is responsible for correct behaviour of the system. The EJ1N-HFU-ETN is a gateway that passes the communicated register values from the PROFINET network to Modbus RTU nodes and vice versa.

Please note that the EJ1N-HFU-ETN can be directly connected to the left side of an End Unit as well. The EJ1N-HFU-ETN acts as a gateway without the need of having EJ1 temperature controllers directly connected.

Modbus RTU Node Configuration

The EJ1N-HFU-ETN communicates to temperature controllers and other equipment via the Modbus RTU protocol over RS485.

Select one baud rate and parity setting common for all Modbus RTU nodes that will be connected to the EJ1N-HFU-ETN. The amount of stop bits depends on the parity setting. The amount of stop bits is 2 if the parity is set to none. Otherwise the amount of stop bits is 1.

EJ1 temperature controllers must be configured to support Modbus RTU on port B instead of the default protocol: Compoway/F.

Follow the next steps to configure an EJ1 temperature controller to support Modbus RTU on port B:

- Switch on SW2 the switches 2 and 8 to OFF
- Use SW1 and SW2 switch 1 to select the correct Modbus node address between 1 and 31.
- Set, using CX-Termo, in the TC Communication settings
 - Port B Protocol to Modbus
 - Port B Baud Rate as selected
 - Port B Data Length to 8
 - Port B Stop Bits and Parity combination as selected (see above)

For a detailed explanation about the switches, please refer to the EJ1 manual H142.

Repeat the steps above for all temperature controllers and make sure that each temperature controller has a different Modbus node address.

Installation Procedure

Follow the next steps to connect an EJ1N-HFU-ETN to EJ1 Temperature Controller units and an End Unit:

- Power down the EJ1 system
- Align and connect the EJ1N-HFU-ETN at the left side of the Temperature Controllers
- Align and connect the End Unit at the right side of the Temperature Controllers
- Slide the yellow sliders on the top and bottom of the unit until the sliders click into place
- Mount the EJ1 system to a grounded DIN rail between end stops
- Push the EJ1 system to the left until the grounding plate at the back side of the EJ1N-HFU-ETN properly connects to the DIN rail end stop.
- Power up the EJ1 system
- Assign a PROFINET device name via a PROFINET network scan tool as included in e.g. CX-ConfiguratorFDT. Please refer to the PROFINET IO Controller manual.

PROFINET Wiring

The EJ1N-HFU-ETN unit is supplied with three RJ45 Ethernet connectors. Connect any of the Ethernet ports to the PROFINET IO Controller, if necessary via an Ethernet switch. The EJ1N-HFU-ETN unit cannot be part of a redundant Ethernet ring.

Follow the guidelines in the "PROFINET Installation Guideline for Cable and Assembly" (PNO Order No. 8.072) regarding:

- Ethernet cable selection and assembly
- Wiring and handling of the Ethernet cables
- Grounding and equipotential bonding

Modbus RTU Wiring

Connect other Modbus RTU nodes than EJ1 Temperature Controllers via a shielded cable to terminals 6 and 7 of the End Unit. Please note:

- Connect the cable shield to functional ground
- Separate the cable from power lines.

GSDML File and Omron CX-ConfiguratorFDT

Omron provides a GSDML file for the EJ1N-HFU-ETN unit via the myomron.com website. The GSDML file is named:

GSDML-V2.2-OMRON-EJ1N-HFU-ETN-yyyymmdd.xml

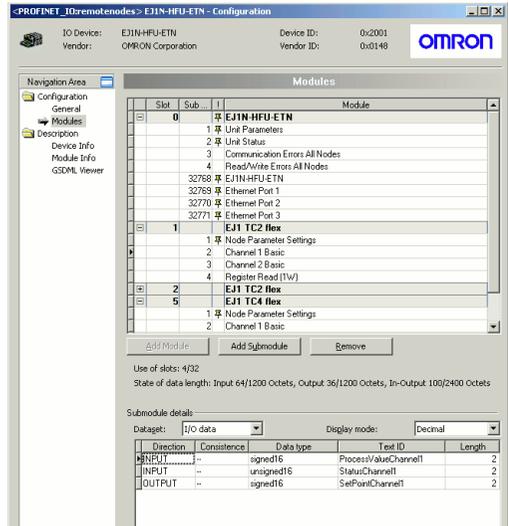
The yyyy, mm and dd part of the file name is replaced by the GSDML file release date elements year, month and day respectively.

CX-ConfiguratorFDT is the configuration program for Omron PROFINET IO Controllers.

Please update CX-ConfiguratorFDT to August 2011 or newer.

Start CX-ConfiguratorFDT, open the Device Catalogue and use the button "Install Device Description Files...". Select the GSDML file with the name mentioned above to start using the EJ1N-HFU-ETN together with Omron PROFINET IO Controllers. The unit will appear in the Device Catalogue as "EJ1N-HFU-ETN".

The picture below shows CX-ConfiguratorFDT with an EJ1N-HFU-ETN configuration example.



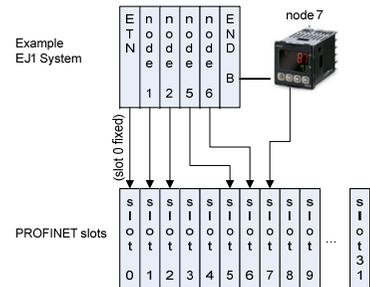
Unit Configuration

The EJ1N-HFU-ETN is configured using the configuration program for the PROFINET IO Controller. Use the Unit Parameters submodule of the EJ1N-HFU-ETN module (slot 0, sub-slot 1) to configure baud rate and parity setting as selected in the section Modbus RTU Node Configuration.

The EJ1N-HFU-ETN configuration is completed by assigning and configuring Modbus RTU nodes. This configuration step is described in the next section.

Temperature Controller / Modbus Node Allocation

The EJ1N-HFU-ETN provides 31 PROFINET slots for Modbus node addresses 1..31. Use the PROFINET configuration tool to assign EJ1 Temperature Controllers and other Modbus RTU nodes as modules to slots. A slot number corresponds with the Modbus node address. Slots may be skipped if a node address is not used. Please refer to the figure below.



Several modules are available that reflect a Modbus RTU node. The table below shows the available modules and the module parameters.

Module	Parameter	Description
Modbus Node	Timeout	Response timeout in 0.1 second units A timeout of 0 (zero) means 5 seconds
	Backup Total	Amount of registers to backup
	Backup Start	Start register of the backup register range
	Support RW	Yes: node supports Modbus function 23 No: node does not support function 23
EJ1 TC2 flex	Retries	Amount of retries before error indication
	Timeout	Response timeout in 0.1 second units A timeout of 0 (zero) means 5 seconds
EJ1 TC4 flex	Retries	Amount of retries before error indication
	Timeout	Response timeout in 0.1 second units A timeout of 0 (zero) means 5 seconds
	Retries	Amount of retries before error indication

The EJ1 TC2 flex module and the EJ1 TC4 flex module represent an Omron EJ1N-TC2 and an Omron EJ1N-TC4 respectively.

All modules provide free sub-slots for I/O data assignment.

I/O Data Assignment

The sub-slots in the EJ1N-HFU-ETN unit's modules provide space for sub-modules. The available sub-modules represent I/O data that is continuously being transferred to or from registers in a Modbus RTU node.

Sub-Module	Module Support	Description and Configuration
Register Write (1W)	Modbus Node	Writes PROFINET output data into one Modbus register. Configure the register address.
	EJ1 TC2 flex	
	EJ1 TC4 flex	
Register Read (1R)	Modbus Node	Reads one Modbus register into PROFINET input data. Configure the register address.
	EJ1 TC2 flex	
	EJ1 TC4 flex	
Register Write (2W)	Modbus Node	Writes PROFINET output data into two Modbus registers. Configure both register addresses.
	EJ1 TC2 flex	
	EJ1 TC4 flex	
Register Read (2R)	Modbus Node	Reads two Modbus registers into PROFINET input data. Configure both register addresses.
	EJ1 TC2 flex	
	EJ1 TC4 flex	
Channel 1 Basic	EJ1 TC2 flex EJ1 TC4 flex	Set Point , Process value and Channel Status of TC channel 1
Channel 2 Basic	EJ1 TC2 flex EJ1 TC4 flex	Set Point , Process value and Channel Status of TC channel 2
Channel 3 Basic	EJ1 TC4 flex	Set Point , Process value and Channel Status of TC channel 3
Channel 4 Basic	EJ1 TC4 flex	Set Point , Process value and Channel Status of TC channel 4

The Register Write and Register Read sub-modules are also available in 4 and 8 word size. Configuration is required for each individual register address. A default of 0 (zero) indicates that the register is not used.

Modbus on TCP Support

The EJ1N-HFU-ETN services Modbus on TCP requests during the time it exchanges I/O data with a PROFINET IO Controller. Use the IP address as configured for PROFINET. The EJ1N-HFU-ETN will gateway the request to the Modbus RTU node as identified using the Unit Identifier in the Modbus on TCP message.

The list of supported Modbus registers is listed on the myomron.com website. Also refer to this website for using Modbus on TCP without having a PROFINET IO Controller.

Diagnosis and LED Indicators

The table below shows the meaning of the LED indicators.

Indicator	Status	Meaning
RUN	Green	Normal operating status
	Off	The unit is initializing
ERR	Red	The product detected an error and cannot continue
	Blinking	Backup or restore operation failed
	Off	The unit is operating normally
COMM	Green	A PROFINET IO Controller connected properly
	Off	No PROFINET IO Controller connected
BF	Red	No PROFINET IO Controller connected
	Blinking	The last PROFINET connection is not accepted
	Off	A PROFINET IO Controller connected properly
TS	Green	All assigned Modbus nodes are communicating
	Blinking	Backup or restore operation in progress
	Red	Communication failure with all Modbus RTU nodes
	Blinking	Communication failure with at least one Modbus RTU node
	Off	No Modbus RTU nodes assigned

For detailed diagnosis on error situations and Ethernet diagnosis consult the myomron.com website.

Unit Status

The EJ1N-HFU-ETN always provides unit status information in slot 0 of the PROFINET configuration.

Bit	Name	Description
0	Unit Ready	1: Unit is ready to accept requests 0: Unit is initialising
1	Status Port 1	1: Port 1 is operating at 100M, full duplex 0: Port 1 is operating at either 10M or half duplex
2	Status Port 2	1: Port 2 is operating at 100M, full duplex 0: Port 2 is operating at either 10M or half duplex
3	Status Port 3	1: Port 3 is operating at 100M, full duplex 0: Port 3 is operating at either 10M or half duplex
8	Backup	1: BACKUP switch is set to ON 0: BACKUP switch is set to OFF
9	Restore	1: RESTORE switch is set to ON 0: RESTORE switch is set to OFF

Note: Check the bits 1-3 for being ON during operation. Communication failures may occur otherwise.

Unit Communication Status

The EJ1N-HFU-ETN optionally can provide the communication status of the assigned Modbus RTU nodes. One sub-module is available in slot 0 showing to which assigned Modbus RTU nodes the EJ1N-HFU-ETN cannot communicate. Another sub-module is available showing register access errors while exchanging the configured I/O data. Assign a sub-module to a sub-slot to make this data available for the application.

The data available in the word for nodes 1-15 is a 16-bit value

Bit	Name	Description
0	Comm Error	1: At least one Modbus node is not communicating 0: All assigned Modbus nodes are communicating
1-15	Node Error	1: Modbus RTU Node is not communicating 0: Modbus RTU Node is communicating normally

The bit numbers correspond to Modbus node addresses

The data available in the word for nodes 16-31 is a 16-bit value as well

Bit	Name	Description
0-15	Node Error	1: Modbus RTU Node is not communicating 0: Modbus RTU Node is communicating normally

Bit 0 corresponds to Modbus node address 16
Bit 15 corresponds to Modbus node address 31

Modbus RTU Node Register Backup

The EJ1N-HFU-ETN provides the means to support a backup and restore of Modbus node registers. Registers can be stored centrally using an Omron PLC function block. The backup and restore operation can nevertheless be activated locally using the switches.



Note: Before being able to activate backup or restore the following steps are required:

- Download the function block from the myomron website
- Insert the downloaded function block in the PLC program
- Connect the function block enable input to the Ready bit of the Unit Status

Follow the next steps to execute a backup of the assigned Modbus nodes:

- Make sure that the TS LED is Green
- Switch the BACKUP switch to ON
- The PLC program starts the backup of the configured backup register ranges (see the module parameters above). The TS LED starts blinking green.
- Wait until the TS LED switches back to Green again.
- Switch off the BACKUP switch

Follow the next steps to execute a restore of the assigned Modbus nodes:

- Make sure that the TS LED is Green
- Switch the RESTORE switch to ON
- The PLC program starts the backup of the configured backup register ranges (see the module parameters above). The TS LED starts blinking green.
- Wait until the TS LED switches back to Green again.
- Switch off the RESTORE switch