OMRON

# EJ1N-HFU-ETN
# Ethernet/IP Interface

## Operation Manual

ENGLISH

# Contents

# 1   Introduction

The EJ1N-HFU-ETN enables remote communication with multiple EJ1N-TC2 Temperature Controllers (TCs) through Profinet IO or Ethernet/IP network. This allows for control operation, monitoring the process values and writing parameters of up to 24 Temperature Controllers.

This document will introduce configuration and operation of the EtherNet/IP interface of the EJ1N-HFU-ETN.

The EDS file provided with the Unit supports the following functions:

1. Set the specific sizes of the cyclic input and output buffers
2. Allocate the cyclic IO data in a flexible way
3. Configure the Temperature Controllers
4. Set the Temperature Controller parameters to backup and restore

Please be sure to read the related manuals to use the EJ1N-HFU-ETN Unit safely and properly.

| Reference | Name | Cat. No. |
|---|---|---|
| [1] | EJ1 Modular Temperature Controllers User's Manual | H142 |
| [2] | NJ-series CPU Unit Built-in Ethernet/IP Port User's Manual | W506 |

## 2   EJ1N-HFU-ETN Specifications

| Item | | Specification |
|---|---|---|
| Installation | Unit Type | Ethernet Gateway (Profinet IO and Ethernet/IP) to EJ1N Temperature Controllers |
| | Model | EJ1N-HFU-ETN |
| | Dimensions (WxHxD) | 31mm x 90mm x 72mm |
| | Weight | 170g |
| Environment | Ambient operating temperature | -10 ºC to 55 ºC |
| | Ambient operating humidity | 25% to 85% |
| | Ambient storage temperature | -20 ºC to 65 ºC |
| EtherNet Interface | Communications protocol | EtherNet/IP |
| | Communication ports | 3 |
| | Communication speed | 100 Mbps |
| | Supported Assemblies | Basic I/O (Input assembly 100, Output assembly 110) |
| | Default IP address | 192.168.0.4 |
| Modbus-RTU Interface | Modbus node range | 01 to 24 |
| | Communication settings | Fixed to 38400, 8, E, 1 |
| | Compatible TCs | EJ1N-TC2 |

# 3 EJ1N-HFU-ETN Configuration

Use the following procedure to prepare the Unit for use. Refer to the reference sections for details on the indicated steps.

| Step | Item | Section** |
|------|------|-----------|
| 1 | Connect the Unit, the Temperature Controllers and the End Unit. | [1], section 2 |
| 2 | Connect the power supply. | [1], section 2 |
| 3 | Wire the Temperature Controllers. | [1], section 2 |
| 4 | Set the communications unit numbers of the Temperature Controllers. | [1], section 1.1.4 |
| 5 | Select EtherNet/IP interface for the Unit | 3.2 Enable EJ1N-HFU-ETN EtherNet/IP interface |
| 6 | TC: Set the communication settings of the Temperature Controllers | 3.4 TC: Setting TC communication settings |
| 7 | Set-up the Ethernet Network | [2], section 2 |
| 8 | Turn ON the power to the End Unit | - |
|  | Operate the following steps from the Configurator* | - |
| 9 | Install the EDS file* | 3.1 Install EDS file |
| 10 | Optionally: Reset Unit's settings to default | 3.3 Reset Unit settings |
| 11 | Set the IP address of the Unit | 3.5 Setting EJ1N-HFU-ETN IP address |
| 12 | EDS: Select the allocated Temperature Controllers | 3.6.1 Unit Allocation |
| 13 | EDS: Configure the input and output buffer sizes | 3.6.2 Input and Output Buffer size |
| 14 | EDS: Set the Modbus RTU timeout and retry values | 3.6.3 Modbus timeout and retry |
| 15 | EDS: Allocate the detailed input and output buffer data | 3.6.4 Input and Output Allocation |
| 16 | EDS: Set the Temperature Controller parameters | 3.6.5 Temperature Controller Parameters |
| 17 | EDS: Set the parameters for backup and restore | 3.6.6 Parameters for backup and restore |
| 18 | Tag Data Links and Start remote I/O communications | [2], section 7 |
| 19 | Send Explicit messages | EtherNet/IP Explicit Messages |

* Operations described using OMRON Network Configurator for EtherNet/IP software.
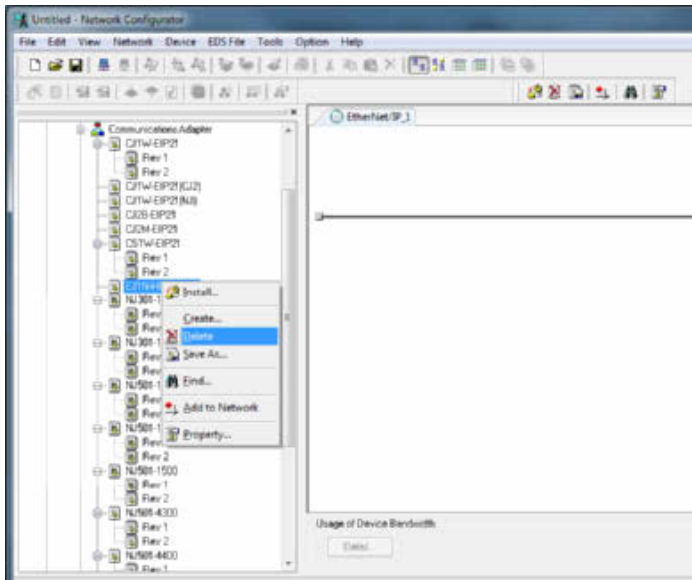
** The references are listed below

| Reference | Name | Cat. No. |
|-----------|------|----------|
| [1] | EJ1 Modular Temperature Controllers User's Manual | H142 |
| [2] | NJ-series CPU Unit Built-in Ethernet/IP Port User's Manual | W506 |

## 3.1 Install EDS file

Follow the steps below to install (a new version of) an EDS file within Network Configurator.

1. Delete the old EDS file (see below picture).



2. Install the new EDS file (EJ1-EIP.eds) using the EDS File ~ Install menu item.

Please check [2], section A-2-1 for detailed information about installing EDS files.

## 3.2 Enable EJ1N-HFU-ETN EtherNet/IP interface

Select the EtherNet/IP interface for the Unit by setting the dip switch no 2 (second from the bottom) to ON and power ON the Unit (see below).
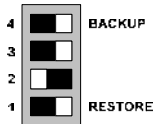


| Pin 2 | Interface setting |
|-------|------------------|
| OFF | Profinet IO and Modbus TCP active |
| ON | EtherNet/IP active |

## 3.3 Reset Unit settings to factory default

Set the dip switch no 3 (second from the top) ON at power up to reset all Unit's settings back to factory default. This includes the IP address, which will be set back to 192.168.0.4.
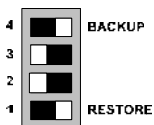


| Pin 3 | Interface setting |
|-------|------------------|
| OFF | No action |
| ON | Reset Unit settings (including IP address) to factory default at power up. |

Follow this procedure:

1. Make sure that the Unit is in Ethernet/IP interface operation (dip switch no 2 = ON)
2. Toggle dip switch no 3 to ON position
3. Power the Unit power briefly OFF and ON again
4. The Unit starts removing the configuration from memory. When it has finished the **TS** Red and Green LEDs will be blinking at the same time
5. Toggle again dip switch no 3 to OFF position

After a complete reset the EJ1N configuration is no longer valid. All the TCs are disabled, no cyclic data is mapped and all the channel parameters are set to 0. The **TS** Red and Green LEDs will be blinking at the same time to show this status.

It is necessary to send a new valid configuration to be able to operate the Unit.

### 3.4 TC: Setting TC communication settings

Please refer to section 7.1 of EJ1 Modular Temperature Controller manual (H142) [1] for details about the communication settings on the Temperature Controllers.

Follow the steps below to set the communication settings correctly using the dip switches SW2 of all the TC modules (EJ1N-TC2):



SW2

**EJ1☐-TC Basic Units**

| SW2 | Meaning |
|---|---|
| 3 **V1.2** | Set to ON when using the Modbus communications protocol for port B. |
| | OFF: The setting of the Port B Communications Protocol parameter is used (default: CompoWay/F). |
| | ON: Modbus is used. |
| 4 to 5 **V1.2** | Set the baud rate of port B. |
| | 4 = OFF, 5 = OFF: The setting of the Port B Communications Baud Rate parameter is used (default: 9.6 kbps). |
| | 4 = ON, 5 = OFF: 19.2 kbps |
| | 4 = OFF, 5 = ON: 38.4 kbps |
| | 4 = ON, 5 = ON: 115.2 kbps |

## 3.5 Setting EJ1N-HFU-ETN IP address

Perform the following steps to change the IP address of the Unit. The factory default IP address is 192.168.0.4.

1. Open Network Configurator
2. Select the Tools ~ TCP/IP Configuration menu item
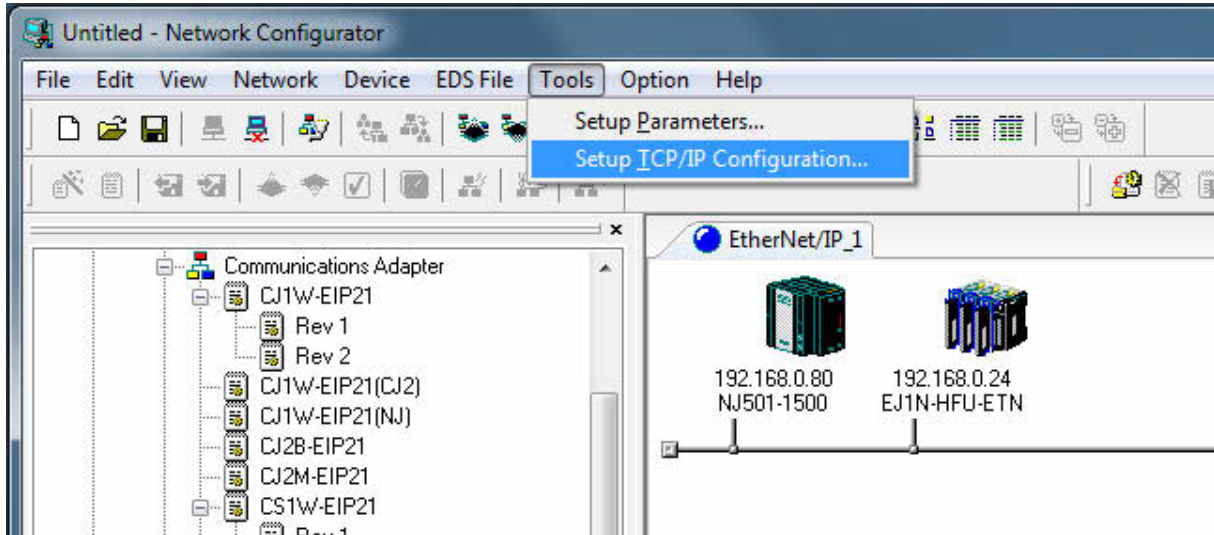


3. Fill in the details of the new IP address



4. Click Set to the Device button

After a power toggle, the new IP address will be active in the Unit.
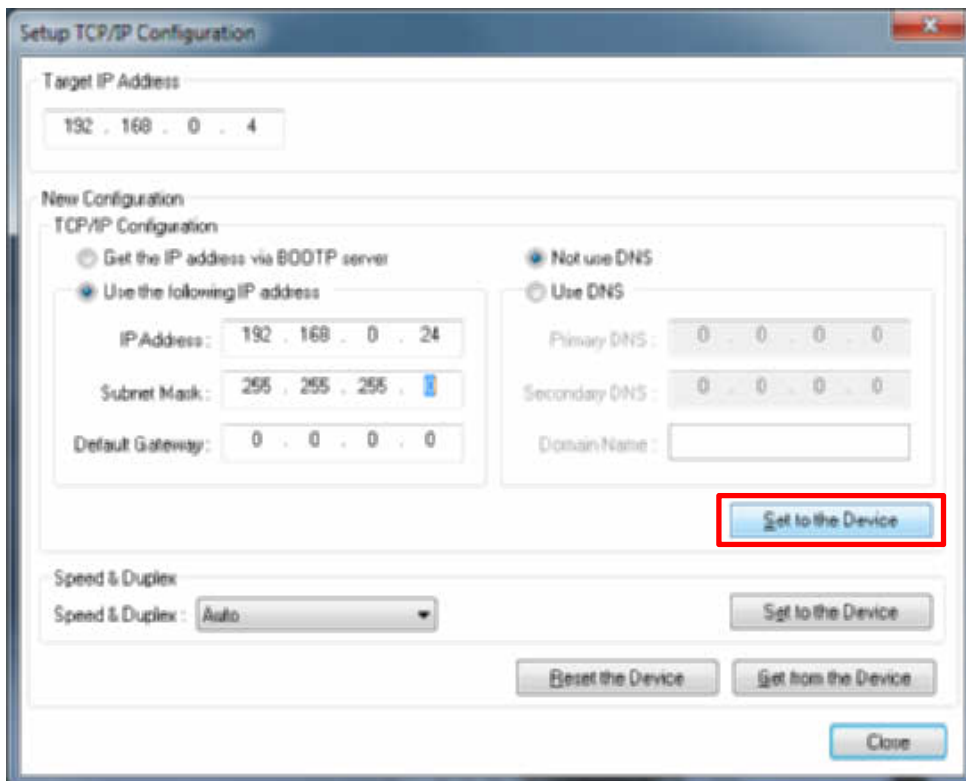
## 3.6    Setting up the Unit for Ethernet/IP

The Network Configurator software allows configuration of different settings related to the Unit and the Temperature Controllers.

Set the parameters of the EJ1N-HFU-ETN Unit as described in the following sections and download it to the physical unit using Network Configurator.

### 3.6.1    Unit Allocation

Select the Temperature Controllers which are connected to the Unit when double-click is done on the EJ1N-HFU-ETN module.
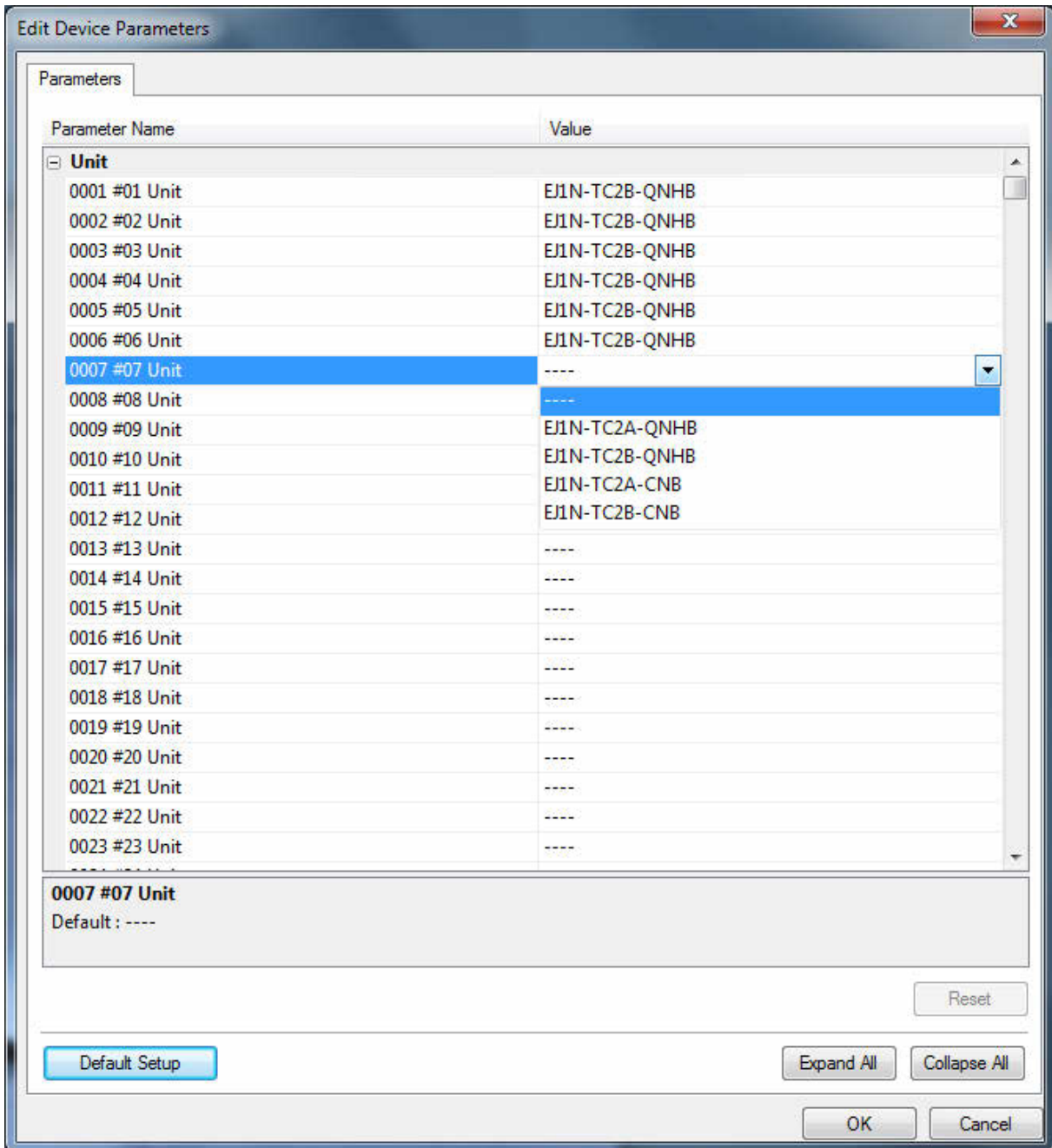


Make sure the Modbus node address (#01 to #24) corresponds to the node setting on the Temperature Controllers (SW1).

*Enable and disable TC units by using Unit allocation*

The Unit allocation parameters can be used to enable and disable TC units without changing the detailed input and output allocation.

In case a particular TC / node is not installed in the machine, perform the following steps will configuring in the Network Configurator:

1. Disable the TC unit by setting the #xx Unit from the Unit Allocation back to default ("---").
2. Keep the other detailed input and output allocation mapping as is (no need to remove the detailed I/O words for this node).
3. Perform a software reset of the coupler (automatically done in the Network Configurator after download).
4. The coupler will not communicate with the disabled TC unit.

Reverse the steps to enable the Temperature Controller again if necessary. The steps can also be done using explicit messaging (not using Network Configurator) by using the Unit Allocation Object (see section A.3 Unit Allocation Object (Class 0x72)).

Please note:

- Any changes to these parameters will always require a (software) reset for the changes to be applied. Do not use power toggle!
- The parameters of a disabled TC unit are not uploaded or downloaded.

### 3.6.2 Input and Output Buffer size

Set the Input and Output buffer size using the following two parameters (see also picture above):

| Parameter | Description |
|---|---|
| TC Output Size | The size of the EJ1N-HFU-ETN Output buffer (in bytes). Range 2 to 400 bytes. |
| TC Input Size | The size of the EJ1N-HFU-ETN Input buffer (in bytes). Range 2 to 400 bytes. |

Please note that one single Temperature Controller register consists of 2 bytes.

### 3.6.3 Modbus timeout and retry

Set the Modbus communication settings using the following two parameters:

| Parameter | Description |
|---|---|
| Modbus Timeout | The response timeout (in milliseconds) of the Modbus RTU interface to the TCs. Range 100 to 65535 ms. |
| Modbus Retries | The amount of retries before error indication. Range 0 to 8 retries. |

### 3.6.4 Input and Output Allocation

For each word of the Input and Output buffer, a specific register can be allocated for one of the Temperature Controllers.
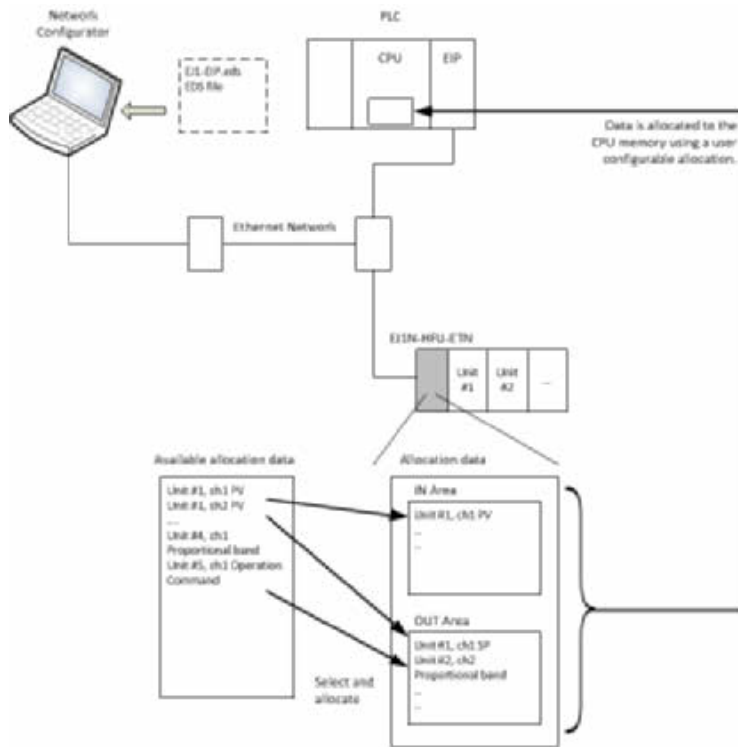
Use Network Configurator to configure the required data for each of the input and output buffer words:

Input
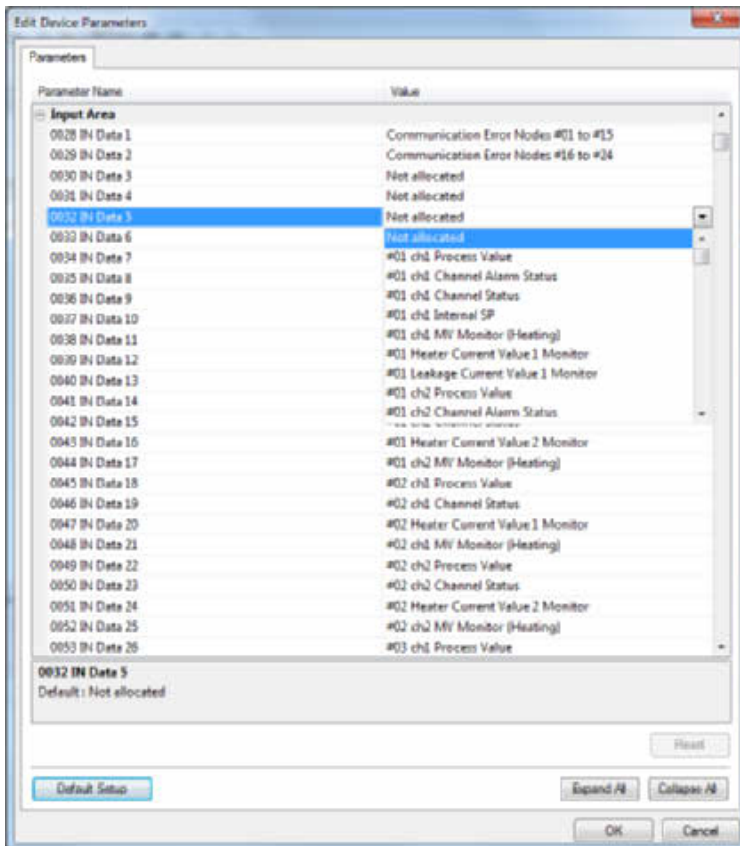
Output
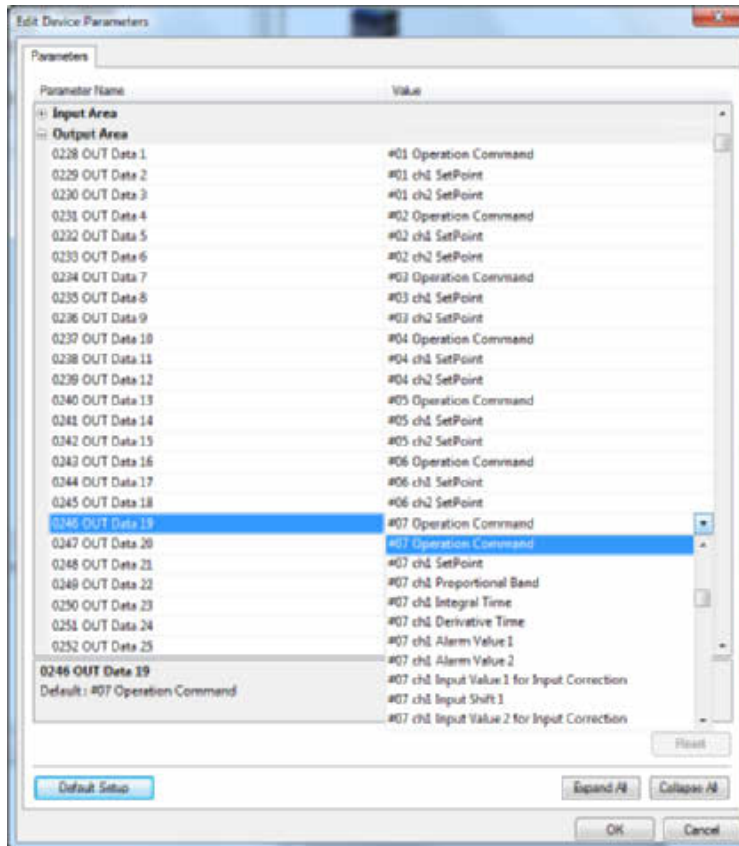


*Notes:*

1. Be sure to put all unused IO allocation (outside the IO buffer) to 'Not allocated'. Not doing so will affect Modbus RTU cycle.
2. The EJ1N-HFU-ETN requires a software reset in order for the new parameter settings to take effect.

### 3.6.5    Temperature Controller Parameters

The Network Configurator software can also be used to set detailed parameters for the connected Temperature Controllers (see below).

**Edit Device Parameters**

Parameters

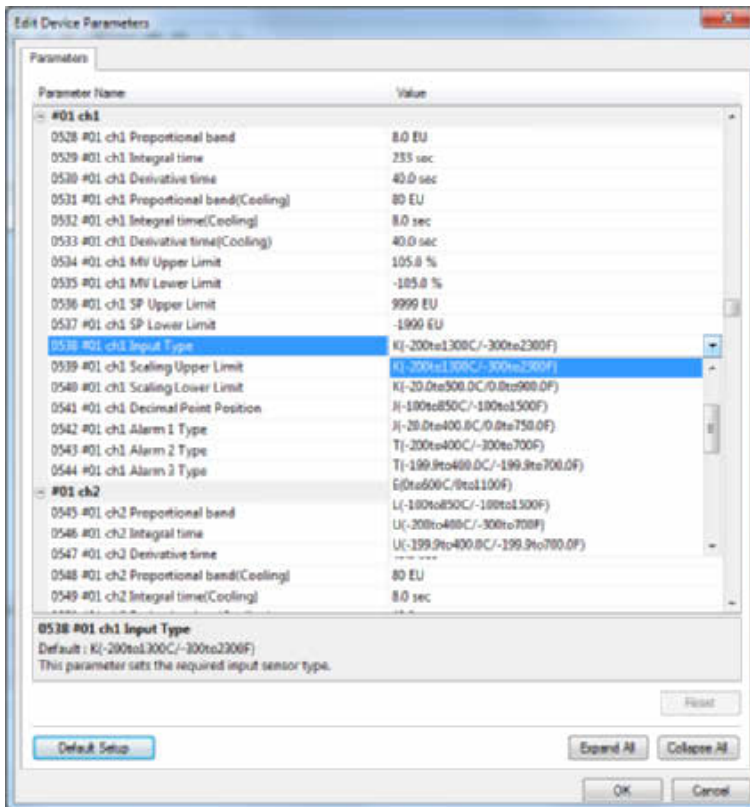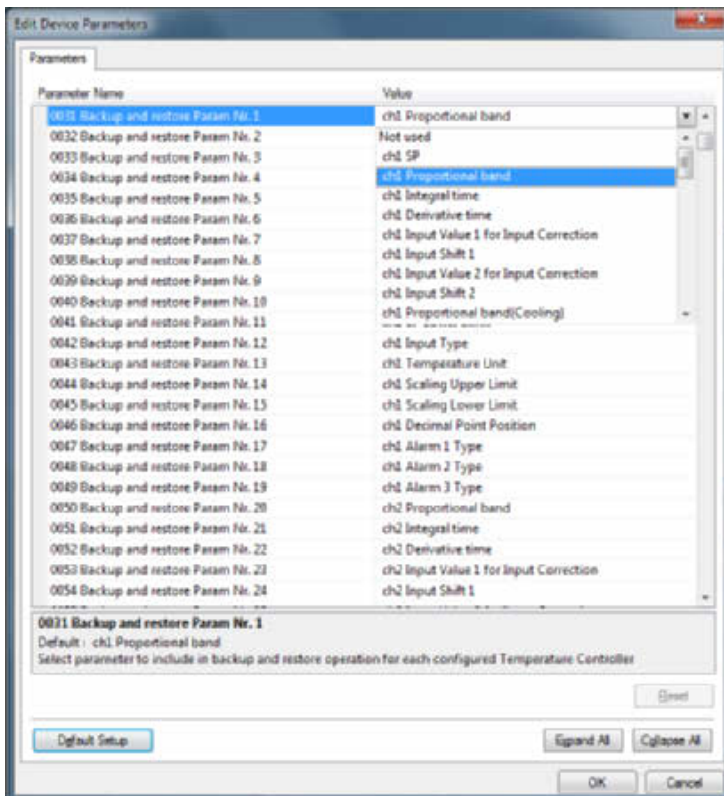| Parameter Name | Value |
|---|---|
| − #01 ch1 | |
| 0528 #01 ch1 Proportional band | 8.0 EU |
| 0529 #01 ch1 Integral time | 233 sec |
| 0530 #01 ch1 Derivative time | 40.0 sec |
| 0531 #01 ch1 Proportional band(Cooling) | 80 EU |
| 0532 #01 ch1 Integral time(Cooling) | 8.0 sec |
| 0533 #01 ch1 Derivative time(Cooling) | 40.0 sec |
| 0534 #01 ch1 MV Upper Limit | 105.0 % |
| 0535 #01 ch1 MV Lower Limit | -105.0 % |
| 0536 #01 ch1 SP Upper Limit | 9999 EU |
| 0537 #01 ch1 SP Lower Limit | -1999 EU |
| 0538 #01 ch1 Input Type | K(-200to1300C/-300to2300F) |
| 0539 #01 ch1 Scaling Upper Limit | K(-200to1300C/-300to2300F) |
| 0540 #01 ch1 Scaling Lower Limit | K(-20.0to500.0C/0.0to900.0F) |
| 0541 #01 ch1 Decimal Point Position | J(-100to850C/-100to1500F) |
| 0542 #01 ch1 Alarm 1 Type | J(-20.0to400.0C/0.0to750.0F) |
| 0543 #01 ch1 Alarm 2 Type | T(-200to400C/-300to700F) |
| 0544 #01 ch1 Alarm 3 Type | T(-199.9to400.0C/-199.9to700.0F) |
| − #01 ch2 | E(0to600C/0to1100F) |
| 0545 #01 ch2 Proportional band | L(-100to850C/-100to1500F) |
| 0546 #01 ch2 Integral time | U(-200to400C/-300to700F) |
| 0547 #01 ch2 Derivative time | U(-199.9to400.0C/-199.9to700.0F) |
| 0548 #01 ch2 Proportional band(Cooling) | 80 EU |
| 0549 #01 ch2 Integral time(Cooling) | 8.0 sec |

**0538 #01 ch1 Input Type**
Default : K(-200to1300C/-300to2300F)
This parameter sets the required input sensor type.

[ Reset ]

[ Default Setup ]          [ Expand All ] [ Collapse All ]

[ OK ] [ Cancel ]

### 3.6.6    Parameters for backup and restore

The Network Configurator is used to set the detailed parameters for the backup and restore function. Be sure to set the parameters before performing the backup operation.

**Edit Device Parameters**

Parameters

| Parameter Name | Value |
|---|---|
| 0031 Backup and restore Param Nr. 1 | ch1 Proportional band |
| 0032 Backup and restore Param Nr. 2 | Not used |
| 0033 Backup and restore Param Nr. 3 | ch1 SP |
| 0034 Backup and restore Param Nr. 4 | ch1 Proportional band |
| 0035 Backup and restore Param Nr. 5 | ch1 Integral time |
| 0036 Backup and restore Param Nr. 6 | ch1 Derivative time |
| 0037 Backup and restore Param Nr. 7 | ch1 Input Value 1 for Input Correction |
| 0038 Backup and restore Param Nr. 8 | ch1 Input Shift 1 |
| 0039 Backup and restore Param Nr. 9 | ch1 Input Value 2 for Input Correction |
| 0040 Backup and restore Param Nr. 10 | ch1 Input Shift 2 |
| 0041 Backup and restore Param Nr. 11 | ch1 Proportional band(Cooling) |
| 0042 Backup and restore Param Nr. 12 | ch1 Input Type |
| 0043 Backup and restore Param Nr. 13 | ch1 Temperature Unit |
| 0044 Backup and restore Param Nr. 14 | ch1 Scaling Upper Limit |
| 0045 Backup and restore Param Nr. 15 | ch1 Scaling Lower Limit |
| 0046 Backup and restore Param Nr. 16 | ch1 Decimal Point Position |
| 0047 Backup and restore Param Nr. 17 | ch1 Alarm 1 Type |
| 0048 Backup and restore Param Nr. 18 | ch1 Alarm 2 Type |
| 0049 Backup and restore Param Nr. 19 | ch1 Alarm 3 Type |
| 0050 Backup and restore Param Nr. 20 | ch2 Proportional band |
| 0051 Backup and restore Param Nr. 21 | ch2 Integral time |
| 0052 Backup and restore Param Nr. 22 | ch2 Derivative time |
| 0053 Backup and restore Param Nr. 23 | ch2 Input Value 1 for Input Correction |
| 0054 Backup and restore Param Nr. 24 | ch2 Input Shift 1 |

**0031 Backup and restore Param Nr. 1**
Default : ch1 Proportional band
Select parameter to include in backup and restore operation for each configured Temperature Controller

[ Reset ]

[ Default Setup ]          [ Expand All ] [ Collapse All ]

[ OK ] [ Cancel ]

The details about the backup and restore functionality can be found in section 5.3 Backup and restore.

### 3.6.7 Downloading the configuration to the devices

After all configuration is done, it is necessary to download it to the devices, that is the PLC (NJ/CJ CPU) and the EJ1N itself. It is possible to do so one at a time (right click over the graphical nodes and select Parameter > Download option) or in one shot using the Download to Network icon

in the toolbar.

> ⚠️ *Be sure to set all connected TCs to STOP mode before downloading the parameters. Downloading a configuration that writes data to a TC that is in RUN mode will fail with a vendor specific error code.*

### 3.6.8 Uploading the configuration from the devices

There is an important remark regarding uploading the configuration from the EJ1N Temperature Controllers to the Network Configurator. When a TC is marked as disabled in the configuration (and this configuration is sent to the EJ1N), the upload will make unusable the data for this particular TC.

The reason is that all requests for reading parameters of a disabled TC will end up in an "empty data" response. This "empty data" value results in value 0 in the parameters, which for some parameters is a value out of range. When this TC is enabled and the complete configuration is downloaded to the EJ1N, this download operation will fail.

Two additional remarks:

- This behavior does not have influence on the enabled Temperature Controllers in any way.
- After uploading pay special attention when adding (enabling) an additional Temperature Controller in the configuration. Be sure all parameters of this TC have been set properly before downloading.

# 4   EJ1N-HFU-ETN LED Status

The following table shows the meaning of the LED indicators.



| Indicator | Status | Meaning |
|---|---|---|
| RUN | Green | Normal operating status |
| | Blinking | The Unit is initialising |
| | Off | |
| ERR | Red | The product detected an error and cannot continue |
| | Off | Normal operating status |
| COMM | Green | An Ethernet/IP master connection established |
| | Off | No Ethernet/IP master connection established<br>The Unit is in Backup or Restore mode |
| BF | Red | No Ethernet link detected and/or the Unit does not have a valid IP address |
| | Off | Normal operating status |
| TS | Green | All configured Temperature Controllers are communicating |
| | Green Blinking | First communication cycle with Temperature Controllers in progress<br>Backup and restore operation in progress |
| | Red | Communication failure with all Temperature Controllers |
| | Red Blinking | Communication failure with at least one Temperature Controller<br>Backup and restore operation failed |
| | Green and Red Blinking | The reset configuration procedure has finished. The Unit does not contain valid configuration and the IP address is set to factory default value |

# 5   EJ1N-HFU-ETN Operation

## 5.1   Communication Status

The following two communication status input words can be mapped to the Ethernet/IP input data.

**Communication Errors Node #01 to #15**

| Bit | Name | Description |
|---|---|---|
| 0 | Comm Error | ON: At least one Temperature Controller (Unit Number #01-#24) is not communicating<br>OFF: All Temperature Controllers (#01-#24) are communicating normally |
| 01-15 | Node Error | ON: Temperature Controller of Unit number (#01-#15) is not communicating<br>OFF: Temperature Controller of Unit number (#01-#15) is communicating normally |

**Communication Errors Node #16 to #24**

| Bit | Name | Description |
|---|---|---|
| 00-08 | Node Error | ON: Temperature Controller of Unit number/Modbus node (#16-#24) is not communicating*<br>OFF: Temperature Controller of Unit number (#16-#24) is communicating normally* |

*Bits 0 to 8 correspond to Temperature Controller of Unit number #16 to #24

## 5.2   TC Operation Commands and Status

**Operation Commands**

The EJ1 Operation Manual (reference [2] Section 7.5.3) explains how to control the Temperature Controller using the Modbus protocol. Map the Operation Command output word for each Unit (#01 to #24) to control the Temperature Controller.

When executing the operation command, place the command code in the upper byte of the write data and place the TC related information in the lower byte.

| Operation Command | Command Code | TC related information |
|---|---|---|
| Write Mode | 04 | 00: Backup<br>01: RAM |
| Software Reset | 06 | Always 00 |
| RUN | 0A | 00: Channel 1 |
| STOP | 0B | 01: Channel 2 |
| Manual | 0C | 02: Channel 3 |
| Auto | 0D | 03: Channel 4 |
| 40% AT Execute | 0E | FF: All channels |
| 100% AT Execute | 0F | |
| AT Cancel | 10 | |
| Bank 0 Change | 1E | |
| Bank 1 Change | 1F | |
| Bank 2 Change | 20 | |
| Bank 3 Change | 21 | |
| Local SP Change | 22 | |

| Operation Command | Command Code | TC related information |
|---|---|---|
| Remote SP Change | 23 | |
| Reset Error | 2D | Always 00 |
| Alarm 1 Latch Cancel | 32 | 00: Channel 1 |
| Alarm 2 Latch Cancel | 33 | 01: Channel 2 |
| Alarm 3 Latch Cancel | 34 | 02: Channel 3 |
| All Alarm Latch Cancel | 35 | 03: Channel 4<br>FF: All channels |
| Save RAM Data | 37 | Always FF |
| Set value initialization | 38 | Always 00 |
| Save RAM Data 2 | 39 | Always FF |
| Register Unit Configuration | 3B | 00: Reset<br>01: Register |

**Channel Status**

The detailed channel status for each channel is listed below.

| Bit position | Status | Bit description | | Meaning |
|---|---|---|---|---|
| | | 0 | 1 | |
| Bit 0 | RUN/STOP | Run | Stop | Run/Stop can be confirmed. |
| Bit 1 | Auto/Manual | Auto | Manual | Auto/Manual can be confirmed |
| Bit 2 | AT Execute/ Cancel | AT is stopped | AT execution in progress | Can confirm AT Execute/Cancel. |
| Bit 3 | SP Mode | LSP | RSP | SP mode can be confirmed |
| Bit 4 | ST (V1.2) | ST is stopped | ST is executing | ST Execute/Stop status can be checked. |
| Bit 5 | SP Ramp (V1.2) | OFF | Ramp is executing | SP Ramp status can be checked. |
| Bit 6 | Not used. | | | |
| Bit 7 | Not used. | | | |
| Bit 8 | Input Error | No error | Error | An input error has occurred. |
| Bit 9 | RSP Input Error | No error | Error | An RSP input error has occurred. |
| Bit 10 | Not used. | | | |
| Bit 11 | Not used. | | | |
| Bit 12 | Not used. | | | |
| Bit 13 | Not used. | | | |
| Bit 14 | Not used. | | | |
| Bit 15 | Not used. | | | |

## 5.3 Backup and restore

The network consists of the Ethernet/IP Master Unit and the Slave Units. The entire network is affected when a Unit is faulty, so a faulty Unit must be repaired or replaced quickly.

The EJ1N-HFU-ETN Unit has a backup and restore function that can read or write the setting parameters of all the Temperature Controllers connected to the Unit as a batch. The setting parameters are stored in the EJ1N-HFU-ETN Unit.

The specific parameters which will be part of the backup and restore can be selected by the user. Please refer to section 3.6.6 Parameters for backup and restore for details.

Please note that both the backup and restore operation will interrupt the normal communication (both cyclic IO and explicit messaging). Be sure to have the application in a fail-safe state before executing these functions. Normal operation is not feasible during backup and restore operation.

**Backup function**

Use this function to upload the setting parameters from the Temperature Controllers to the EJ1N-HFU-ETN Unit. Perform the following steps:

1. Confirm there is no communication error on the Unit (TS indicator is Green). In case there is an error, please resolve this error before attempting to perform the backup function.
2. Turn ON pin 4 (Backup, at the top) of the DIP switch of the EJ1N-HFU-ETN Unit.
3. Power the Unit briefly OFF and ON again.
4. The Unit will start in backup mode, uploading the data from the enabled TCs and the TS indicator will flash green.
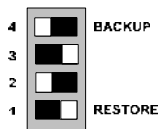


5. If the backup operation completes normally, the TS indicator status will return to be lit green.
   If the backup operation fails, the TS indicator will flash red.
6. Turn OFF pin 4 after the operation.
7. Power the Unit briefly OFF and ON again to return to normal operation.

**Restore function**

Use this function to download the setting parameters from the EJ1N-HFU-ETN Unit to the Temperature Controllers. During the download operation, each of the Temperature Controllers will be reset after the setting parameters have been written.

Perform the following steps:

1. Confirm the execution conditions for restore have been met:
   a. The faulty Temperature Controller has been replaced with a TC of the same model and communication settings (dip switches and node number).
   b. There are no communication errors indicated by the EJ1N-HFU-ETN Unit (TS indicator is Green).
   c. None of the Temperature Controllers are in RUN mode.
      In case there is an error, please resolve this error before attempting to perform the restore function.
2. Turn ON pin 1 (Restore, at the bottom) of the DIP switch of the EJ1N-HFU-ETN Unit.
3. Power the Unit briefly OFF and ON again.
4. The Unit will start in restore mode, downloading the data to the TCs and the TS indicator will flash green.
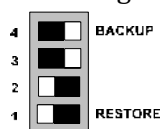
5. If the restore operation completes normally, the TS indicator status will return to be lit green.
   If the restore operation fails, the TS indicator will flash red.
6. Turn OFF pin 1 after the operation.
7. Power the Unit briefly OFF and ON again to return to normal operation.

**Backup and restore troubleshooting**

Perform the following checks in case of failure of the backup and restore operation:

1) Read out the B&R status CIP object (Class 0x74, Instance 0x01 and attribute 0x63) for detailed information on the failure. The value data is specified as

| B&R status object | High word | Low word |
|---|---|---|
| Description | Failure Modbus node | Message error code (see Appendix A.4) |

2) Confirm the faulty Temperature Controller has been replaced correctly with the same model and communication settings.
3) Confirm that in normal mode there are no communication errors indicated by the EJ1N-HFU-ETN Unit (TS indicator is Green). Resolve any issues before performing backup or restore
4) Confirm none of the Temperature Controllers are in RUN mode.
5) Confirm all configured Temperature Controllers are enabled using the Unit Allocation settings (see section 3.6.1). Disabled Temperature Controllers will not be part of the backup operation (and therefore restore operation)

# Appendix A EtherNet/IP Explicit Messages

## A.1    Basic Explicit Message

The basic format of each command and response is shown below.

Command:

Destination node address
Service code
Class ID
Instance
Service Data

Response:

No. of bytes received
Source node address
Service code
Service Data
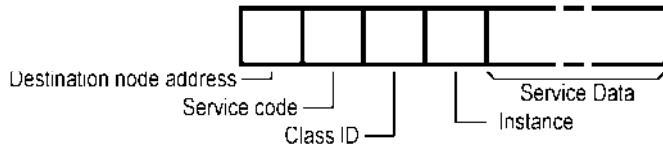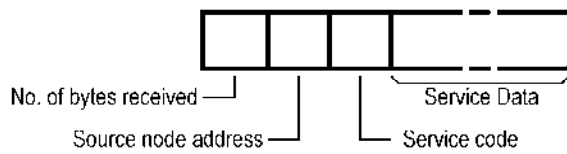
Service codes supported by the Unit are

| Service | Read | Write | Reset |
|---|---|---|---|
| Command | 0E Hex | 10 Hex | 05 Hex |
| Normal response | 8E Hex | 90 Hex | 85 Hex |

*Example*

The following command will reset the Unit.

Command:

| | 05 | 01 | 01 |

Destination node address
Service code
Class ID
Instance

Response:

| 02 | | 85 |
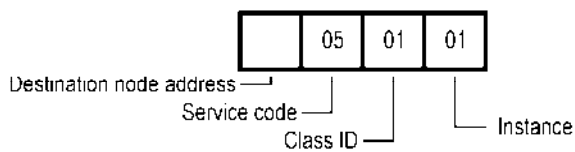
No. of bytes received
Source node address
Service code
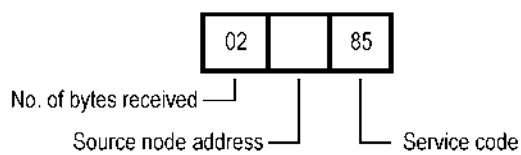
## A.2    Modbus Register Object (Class 0x64)

**Supported Service Codes**

| Service Code No. (hex) | Service |
|------------------------|---------------------|
| 0E | Get attribute single |
| 10 | Set attribute single |

**Supported Instance and Attribute Codes**

For this Object, the targeted Temperature Controller node and corresponding Modbus register are mapped to the object's Instance and attribute.
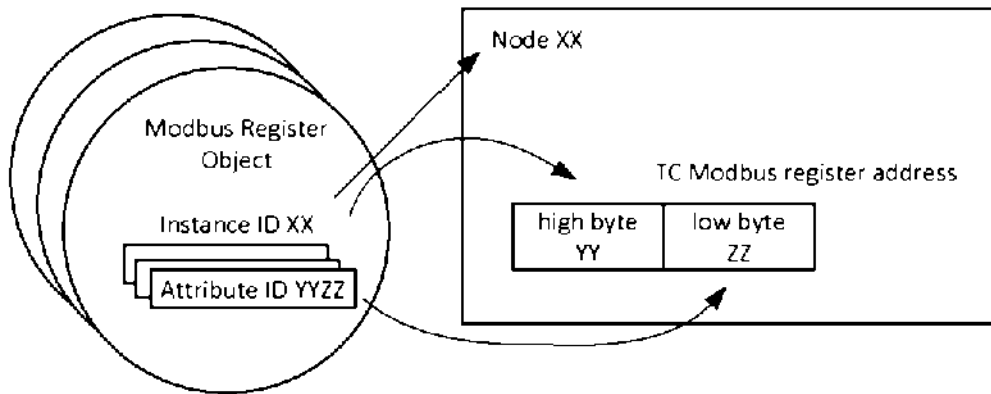


For the CIP object, the attribute value 0000 Hex cannot be used. In case of writing to Modbus address 0000 Hex, use attribute value FFFF Hex instead.

*Example 1:*

Read Leakage Current Value 1 Monitor (Modbus register 0221) of Temperature Controller unit #05.

Command:
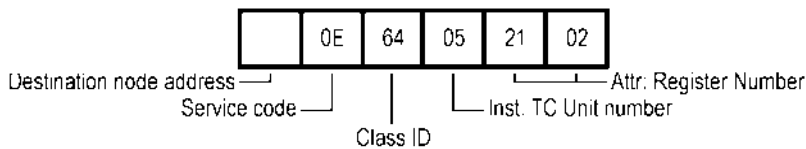


Please note that the Register number value is swapped.

Response:
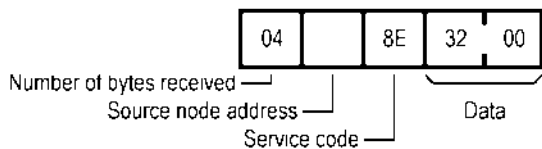
In this case the Leakage Current value is 5.0 A. Note that the data is swapped.

*Example 2:*

Write Present Bank Alarm Value 1 – CH1 (Modbus register 02CD) of Temperature Controller #10 (new value is 100 EU).

Command:
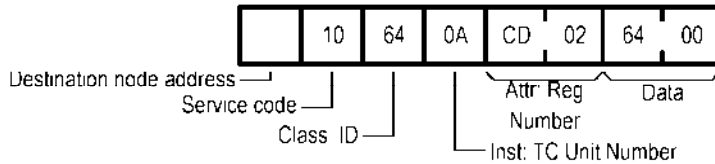


Response:
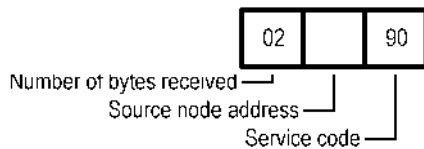


*Example 3:*

Write any new settings of the Temperature Controller #04 to non-volatile memory. Use attribute value FFFF Hex to write to Modbus register 0000 Hex.

Command:
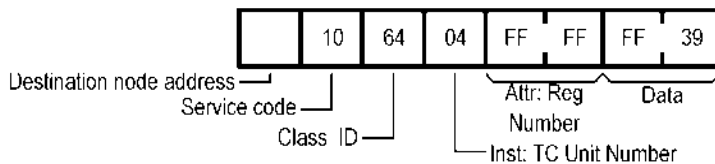


Response:
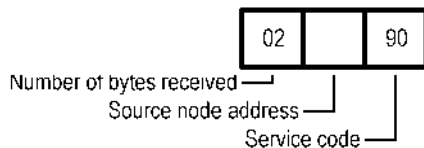


## A.3    Unit Allocation Object (Class 0x72)

**Supported Service Codes**

| Service Code No. (hex) | Service |
|---|---|
| 0E | Get attribute single |
| 10 | Set attribute single |

**Supported Instance and Attribute Codes**

This CIP Object holds the list of enabled Temperature Controllers present on the system (as defined in section 3.6.1 Unit Allocation).

| Class | Instance | Attribute | Value (decimal) | |
|-------|----------|-----------|-----------------|---|
| 72 Hex | TC number (#01 to #24) | 64 Hex (Fixed) | 0 | Unit not present (disabled) |
| | | | 769 | EJ1N-TC2A-QNHB |
| | | | 1025 | EJ1N-TC2B-QNHB |
| | | | 1281 | EJ1N-TC2A-CNB |
| | | | 1537 | EJ1N-TC2B-CNB |
| | | | Others | Reserved, do not use |

Use the explicit message as described above to enable or disable specific Temperature Controllers for your machines. After setting the parameters, be sure to send a software reset as described in section A.1 Basic Explicit Message.

⚠️ *Please note that writing these objects requires a software reset for the new value to take effect. Do not perform a power toggle after writing these values, as this may result in the changes being lost.*

## A.4    Explicit Message Error Codes

When an error response has been returned for the executed explicit message, the Unit can respond with the following error codes:

**Write read only parameter**

| ERROR | | | | | |
|-------|-------|-------|-------|-------|-------|
| Vendor specific error | | | | | |
| VSE | CNT | Status Info1 (2000) | | Status Info2 (0003) | |
| 1F | 02 | 00 | 20 | **03** | **00** |

**Write parameter not allowed in RUN mode**

| ERROR | | | | | |
|-------|-------|-------|-------|-------|-------|
| Vendor specific error | | | | | |
| VSE | CNT | Status Info1 (2000) | | Status Info2 (0004) | |
| 1F | 02 | 00 | 20 | **04** | **00** |

**Access non-existent parameter**

| ERROR | | | | | |
|-------|-------|-------|-------|-------|-------|
| Vendor specific error | | | | | |
| VSE | CNT | Status Info1 (2000) | | Status Info2 (0002) | |
| 1F | 02 | 00 | 20 | **02** | **00** |

**Access non-existent Temperature Controller**

| ERROR | | | | | |
|-------|-------|-------|-------|-------|-------|
| Vendor specific error | | | | | |
| VSE | CNT | Status Info1 (2001) | | Status Info2 (0005) | |
| 1F | 02 | 01 | 20 | **05** | **00** |

All other error codes are following Ethernet/IP interface specification. Please consult the Ethernet/IP master manual for details.

## Appendix B Sample project: OMRON NJ Series - Sysmac Studio

This part of the document describes how to build a system using the OMRON NJ CPU Unit and Sysmac Studio software together with the EJ1N-HFU-ETN Unit for Ethernet/IP.

### B.1 System overview

The following picture shows an overview of the setup.



NJ CPU    Ethernet(/IP) Network    EJ1N-HFU-ETN

Sysmac Studio    Network Configurator
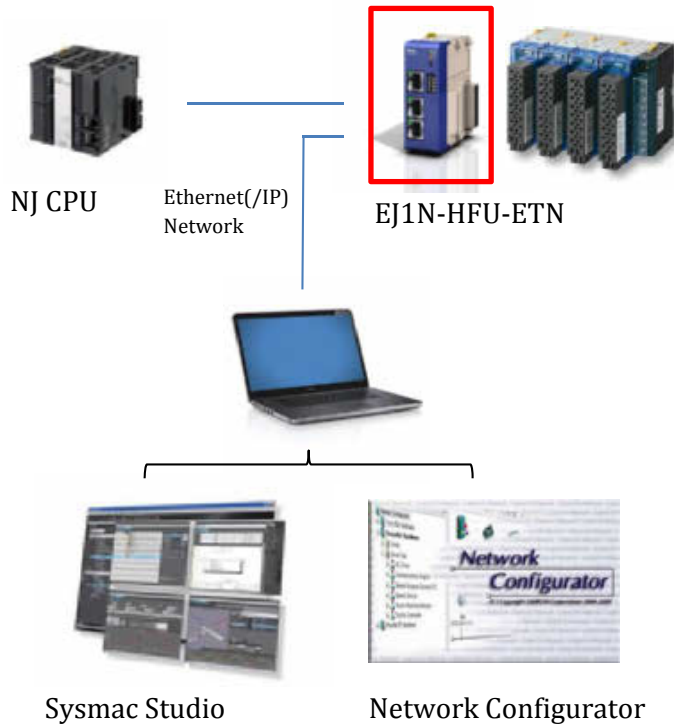
### B.2 Sysmac Studio

To use the integrated Ethernet/IP port the NJ CPU Unit must first have assigned a valid IP address using one of the allowed methods.



The cyclic (implicit) IO exchange mapping is read and written from two arrays (IN/OUT) of 16bit data declared in the global variables. These variables should be marked as *published* in the network for the EJ1N-HFU-ETN to be able to access them.

The final step is to export these variables as a CSV file to allow them to be imported into Network Configurator as tag sets.
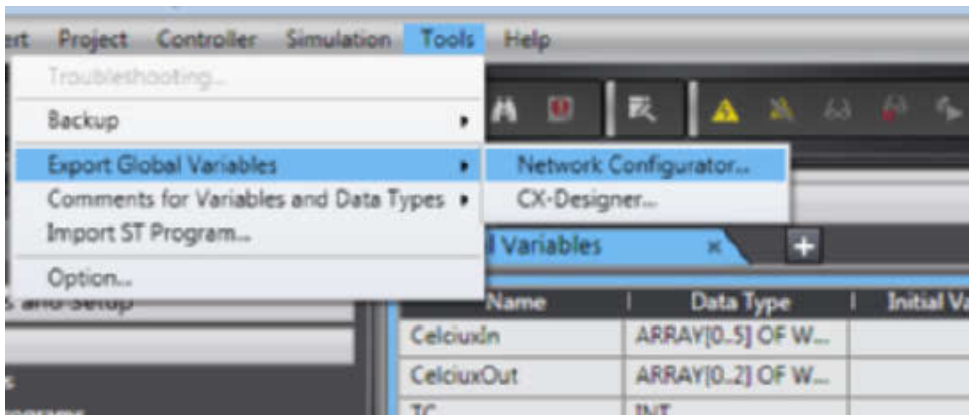


## B.3    Network Configurator

Once the Sysmac Studio project is ready it is time to setup the network and EJ1N-HFU-ETN parameters using OMRON Network Configurator.

It is possible to change the Unit's IP address. The option to do so is available under Tools > Setup TCP/IP Configuration option in the menus.



The next step is to configure the parameters of the EJ1N-HFU-ETN and the related Temperature Controllers. The section 3.6 Setting up the Unit for Ethernet/IP explains the detailed settings which will need to be configured:

The final step implies the creation of the cyclic (implicit) connection. To do so it is necessary to import the network published variables from Sysmac Studio and let Network Configurator create the tags linked to the ones in the PLC.

Once the tags are imported it is possible to define the connection details such as where to map IN and OUT data and the RPI.



To finalize the setup, download (Computer to Network) the configuration to the EJ1N-HFU-ETN and the NJ PLC.
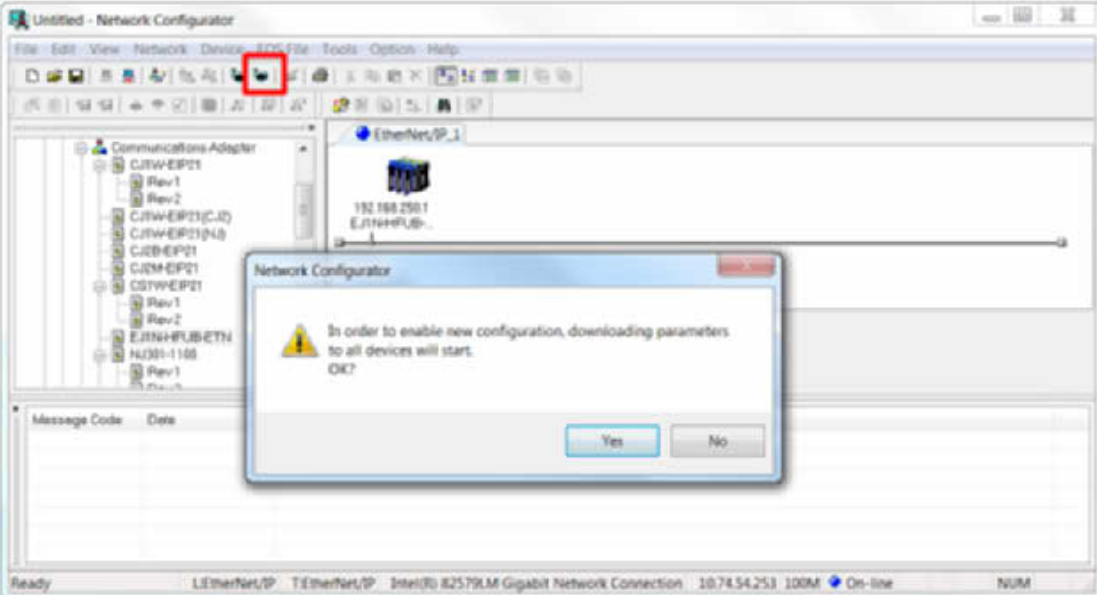
# Appendix C Sample project: Rockwell CompactLogix – RSLogix 5000

This part of the document describes how to build a system using the Rockwell CPU (in this case the Compact Logix 1769/L23E) and RSLogix 5000 software together with the EJ1N-HFU-ETN Unit for Ethernet/IP.
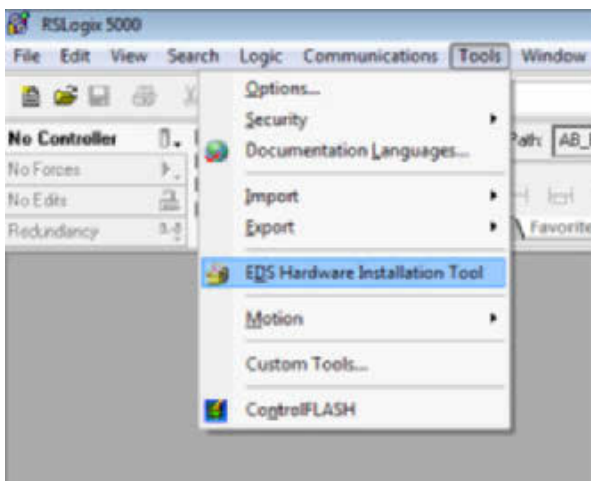
## C.1 System overview

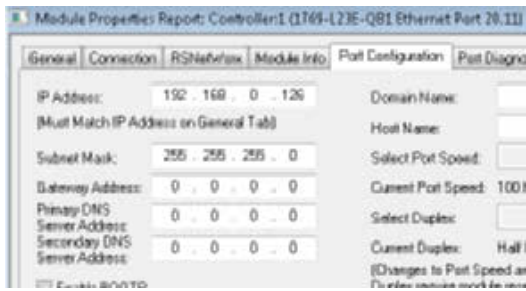The following picture presents an overview of the setup.



1769-L23E   Ethernet(/IP) Network   EJ1N-HFU-ETN

RSLogix 5000        Network Configurator
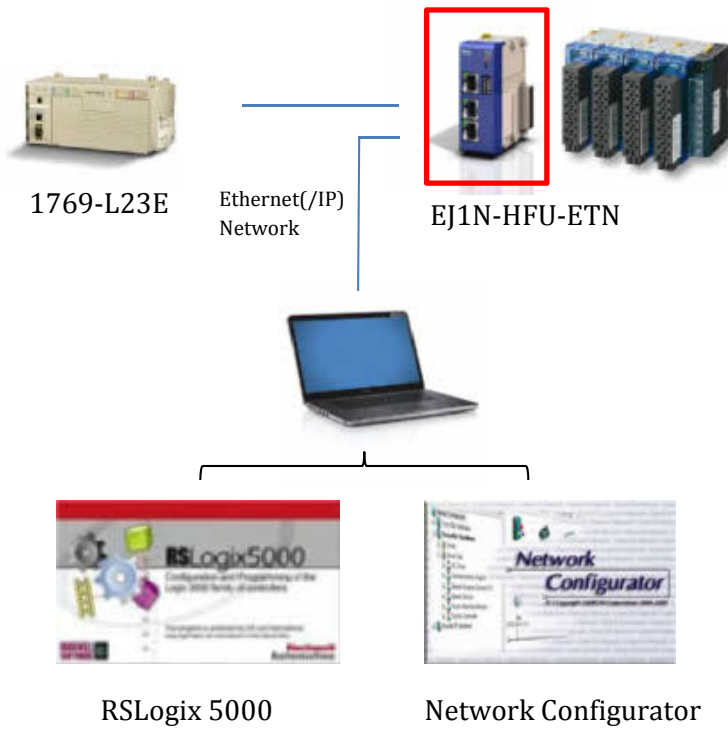
## C.2 RSLogix 5000

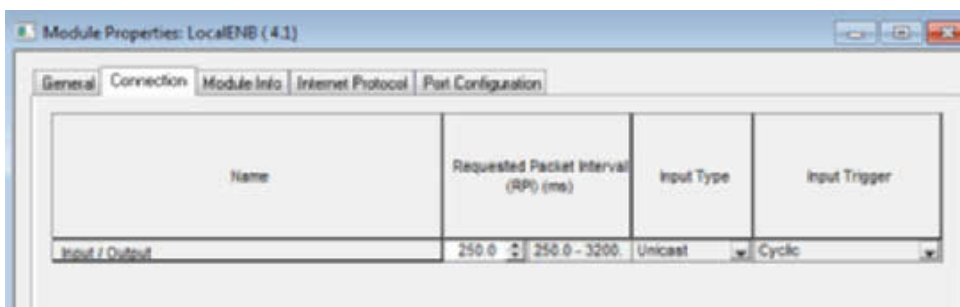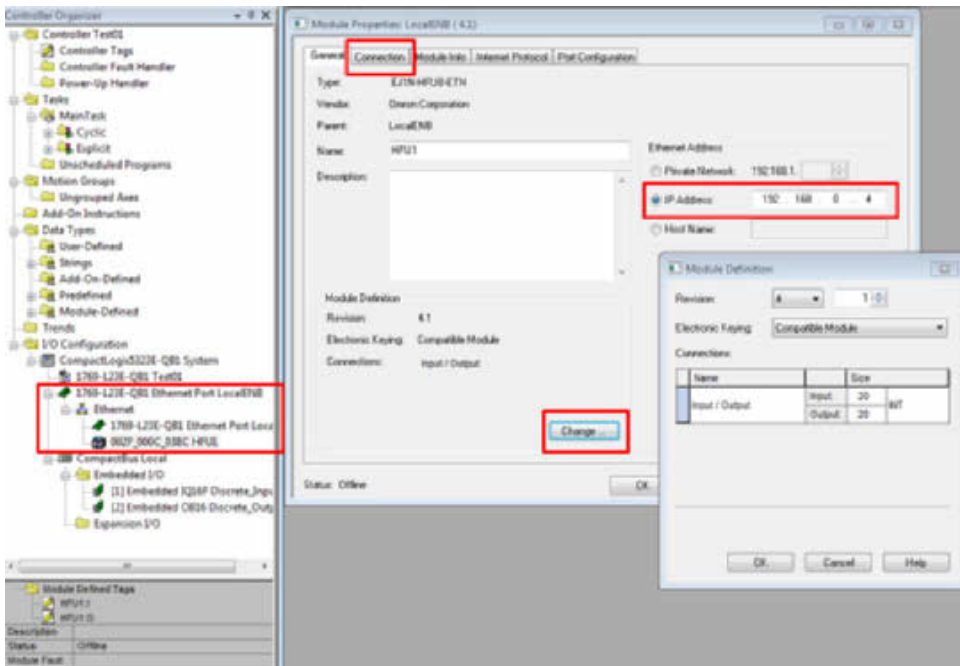The first step before using RSLogix 5000 is installing the EDS file.



The integrated Ethernet/IP port must have a valid IP assigned.

The EJ1N-HFU-ETN can be added to the tree as a *new* device or it is possible to discover it online. Once the module is there it has to be commissioned, including:

- IP address of the module
- Cyclic (implicit) IN/OUT data sizes, mapped type and Packet Interval (RPI)





RSLogix environment creates the cyclic (implicit) data tags automatically.

## C.3    Network Configurator

Follow the same steps as with the OMRON NJ Controller. The only difference is that it is not necessary to download to the Ethernet/IP master, just to download the configuration to the EJ1N-HFU-ETN.

**OMRON**

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