



# Sherpa R-IN32M3 EtherNet/IP adapter communication stack for Renesas Electronics Corporation's R-IN32M3 series industrial Ethernet controller

Technical reference

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## 1. Overview

This document is the technical reference for Sherpa LLC's EtherNet/IP adapter communication stack and its corresponding Sherpa LLC's EtherNet/IP adapter evaluation kit. This EtherNet/IP adapter communication stack has been optimized for the Renesas Electronics Corporation R-IN32M3 industrial network LSI and is the result of the Softing Industrial Automation GmbH's EtherNet/IP adapter stack ported into the R-IN32M3 environment. This document covers the description of the communication stack and its access library, setup of sample application on evaluation board, description of sample application, description of PLC program, scope of support, licensing, additional services and EtherNet/IP adapter stack specification.

## 2. Delivery overview

The Sherpa LLC's EtherNet/IP adapter evaluation kit consists of a downloadable image which contains this technical document as well as the following data:

- Sample EtherNet/IP adapter application in sources optimized for evaluation board described later in this document.
- Evaluation EtherNet/IP adapter stack in binary format, with the full EtherNet/IP adapter functionality but limited to 90 minutes of continued operation. By restarting the sample application, the EtherNet/IP adapter stack can work normally for 90 minutes.
- EDS file for the Sherpa LLC's EtherNet/IP adapter evaluation kit sample application.
- Sample programmable logic controller (PLC) program for CompactLogix industrial controller.
- Additional documentation for detailed access library description, application description and EtherNet/IP adapter description from Softing Industrial Automation GmbH.

## 3. Overview of Sherpa LLC's EtherNet/IP adapter communication stack licensing

The EtherNet/IP adapter communication stack provided as part of the Sherpa LLC's EtherNet/IP adapter evaluation kit is an evaluation product. Its use is strictly restricted for evaluation in laboratory or display environment. This product is not licensed for use in actual industrial devices and the sale of this evaluation EtherNet/IP adapter communication stack is strictly prohibited. In order to use this communication stack in commercial products the device manufacturer must sign a contract with the owner of the intellectual property of this communication stack, Sherpa LLC. For licensing conditions please see clause "Licensing, product development and additional services" at the end of this document.

#### 4. Evaluation and development environment

In order to successfully use the Sherpa LLC's EtherNet/IP adapter evaluation kit in any meaningful way the below minimum setup is required.

Ethernet protocol analyzer software (e.g. Wireshark)

RSLogix 5000 tool with program for Sherpa R-IN32M3 EtherNet/IP adapter application

No.	Time	Source	Destination	Protocol	Length	Info
3.	18.321195	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337569
3.	18.321196	172.20.14.102	172.20.14.102	ENIP	70	Connection: ID=0x987B0001, SEQ=0001337506
3.	18.322215	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337570
3.	18.322216	172.20.15.1	172.20.14.102	ENIP	70	Connection: ID=0x987B0001, SEQ=0001337597
3.	18.323199	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337571
3.	18.323199	172.20.15.1	172.20.14.102	ENIP	70	Connection: ID=0x987B0001, SEQ=0001337598
3.	18.324206	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337572
3.	18.324207	172.20.15.1	172.20.14.102	ENIP	70	Connection: ID=0x987B0001, SEQ=0001337599
3.	18.325187	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337573
3.	18.325187	172.20.15.1	172.20.14.102	ENIP	70	Connection: ID=0x987B0001, SEQ=0001337600
3.	18.326211	172.20.14.102	172.20.15.1	ENIP	66	Connection: ID=0x013401E, SEQ=0001337574

Terminal

```

Stack Status: INIT | ONLINE | NV STORAGE ERROR (0x103)
EVENT_CONTROL_IND_RECEIVED
Network LED: flashing green (Ethernet Link active, no connections established)
EVENT_CONTROL_IND_RECEIVED
I/O LED: flashing green (Any established I/O connection in idle mode)
Size: 28
I/O LED: flashing green (All established I/O connections in run mode)
Size: 88
  
```

IAR Embedded Workbench for ARM version 7.40 or later with Sherpa EtherNet/IP sample application

EtherNet/IP tap (optional)

Managed Ethernet switch with mirroring port capability for packet capturing with DLR capability

CompactLogix Ethernet/IP scanner

R-IN32M3 evaluation board

IAR Systems I-jet ICE

IP Address: 172.20.15.1  
ENET Address: F4:54:33:93:85:40

IP Address: 172.20.15.199

IP Address: 172.20.15.200

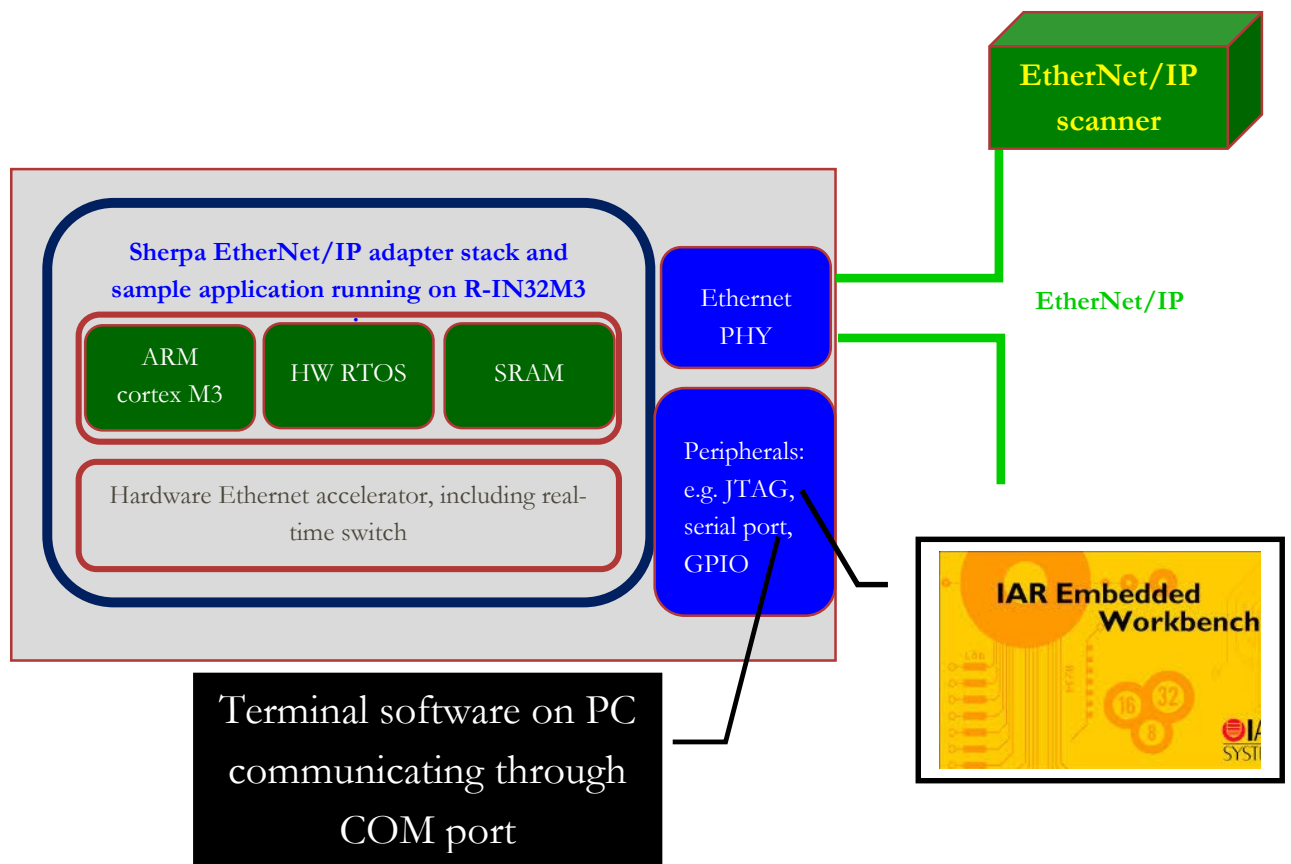
## 5. Support Scope

The Sherpa LLC's EtherNet/IP adapter evaluation kit has been thoroughly tested and confirmed to work in the environment described in the above sections. Should this application be used in "any" kind of different environment Sherpa LLC will regard any inquiry on the use of this EtherNet/IP adapter kit as technical assistance beyond the scope of support for this evaluation application. In this context, "different environment" definition and not covered technical assistance includes, but is not limited to, the below circumstances:

- Any modification of the sources of this sample application
- Use of a compiler other than IAR Systems Embedded Workbench 7.40 or later.  
Note: Sherpa LLC product is optimized for the IAR Systems compiler. Use of any other compiler is not warranted and may require development efforts to be requested to Sherpa LLC
- Use of an EtherNet/IP scanner other than the CompacLogix as described in this document, including other Rockwell scanners and non-Rockwell scanners.
- Any workshop that the end-user may require with regards to EtherNet/IP technology, use of IAR Systems Embedded Workbench tool, use of Rockwell tools or use of EtherNet/IP scanner configuration tools from other vendors, use of Wireshark software, etc..

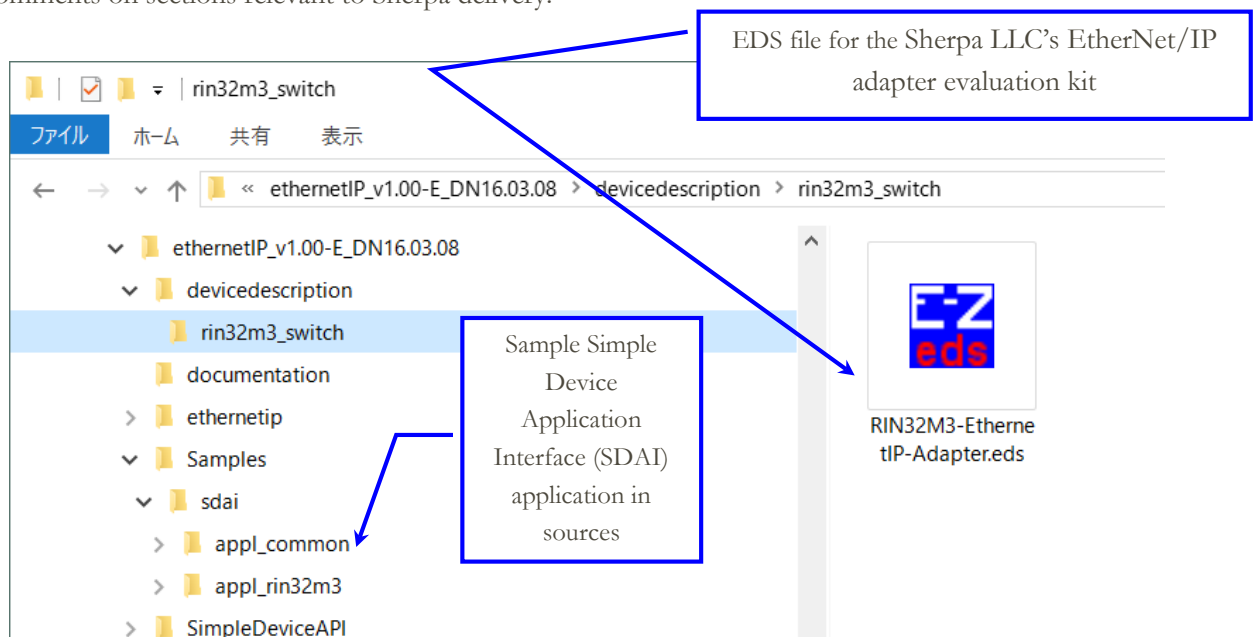
## 6. R-IN32M3 and Sherpa EtherNet/IP adapter

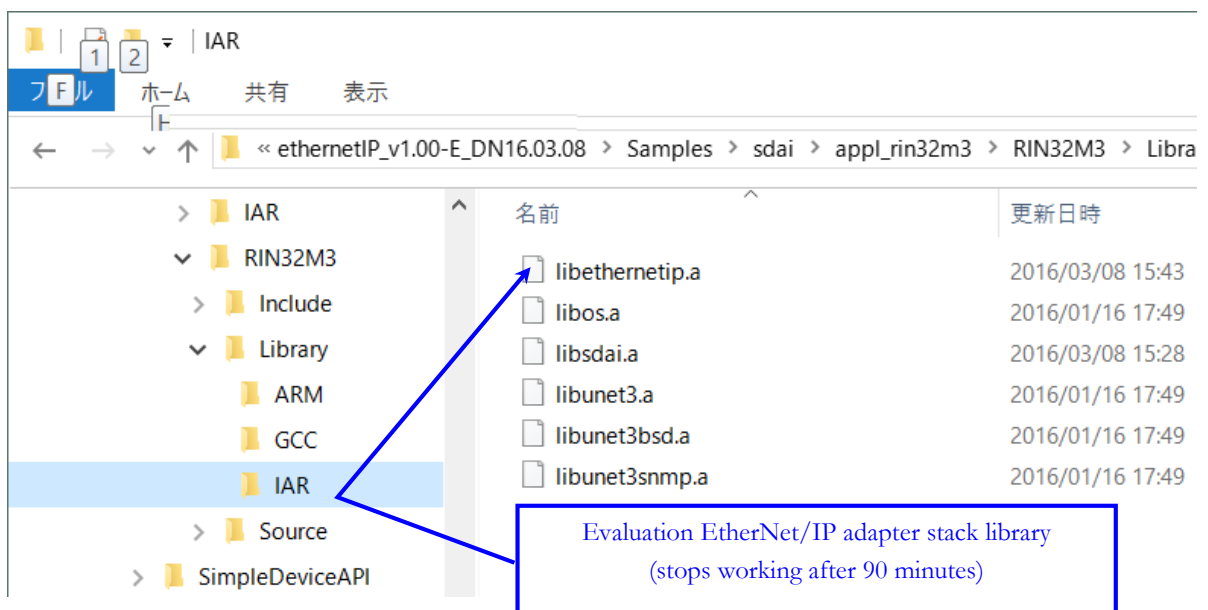
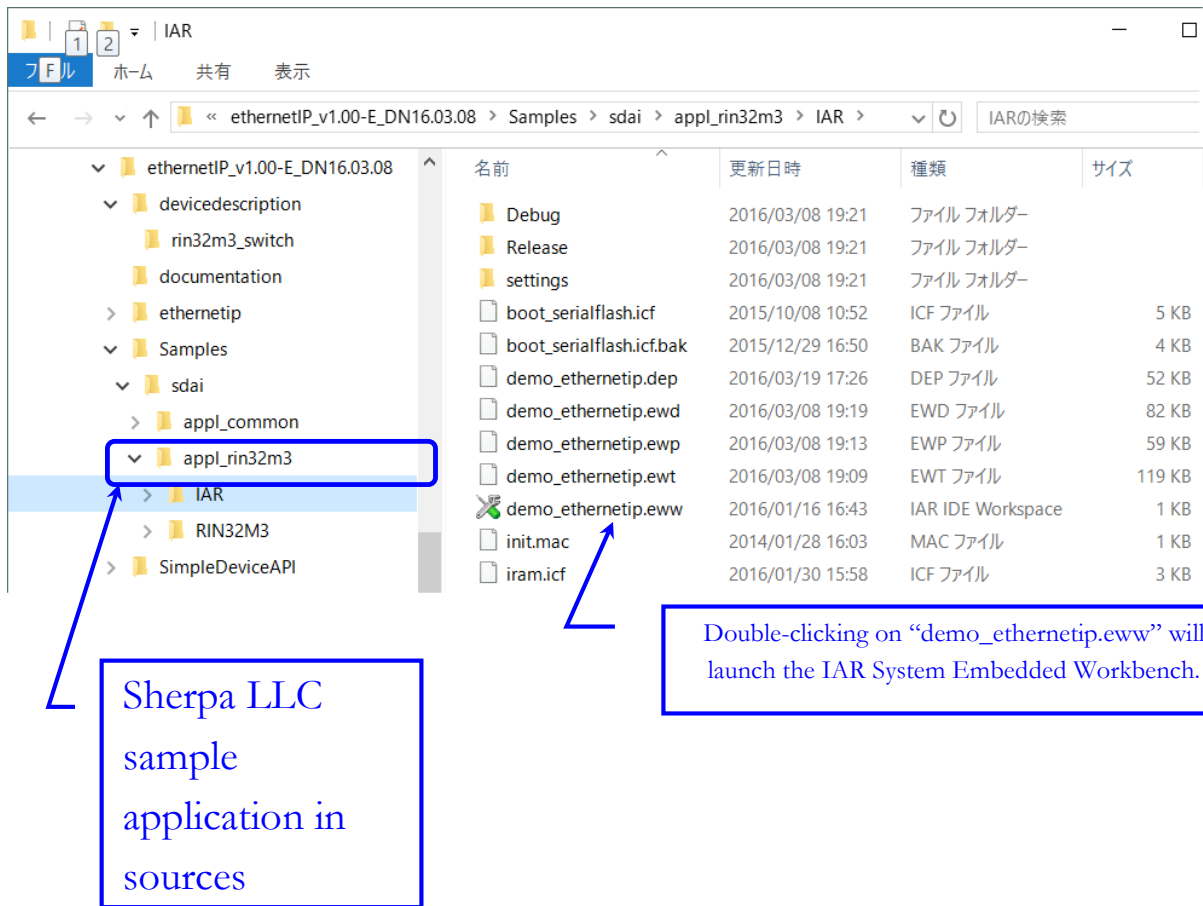
The Sherpa LLC's EtherNet/IP adapter evaluation kit is optimized for the R-IN32M3 and is described as a "simplified" high-level block diagram as per below illustration:



## 7. Delivery description

This section lists the main files that conform the Sherpa LLC's EtherNet/IP adapter evaluation kit with comments on sections relevant to Sherpa delivery:







## 8. EtherNet/IP adapter stack documentation

The EtherNet/IP adapter for R-IN32M3 has been developed by Sherpa LLC by porting the Softing EtherNet/IP adapter communication stack into R-IN32M3 architecture. The EtherNet/IP functionality of this delivery conforms to the Softing product. Detailed explanations are provided in the Softing documentation which is part of the delivery.

NOTE: The Sherpa EtherNet/IP adapter communication stack for R-IN32M3 is licensed and supported by Sherpa LLC. The Softing documentation provided in this delivery is published here with the consent of Softing Industrial Automation GmbH. All support inquiries for the Sherpa LLC's EtherNet/IP adapter evaluation kit should be addressed to Sherpa LLC.

Softing and Sherpa LLC continue working together in the constant evolution and improvement of the EtherNet/IP adapter communication stack. Improvements on the Softing stack will be made available on the Sherpa LLC's EtherNet/IP adapter evaluation kit within a reasonable time frame.

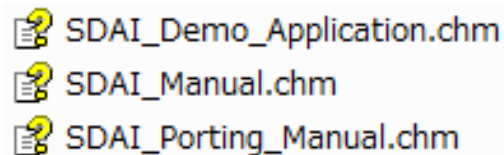
## 9. Simple Device Application Interface

The application programming interface of the Sherpa communication stack is based on Softing's Simple Device Application Interface (SDAI). Detailed explanations are provided in the Softing documentation which is part of the delivery.

## 10. Sample Application

The sample application of Sherpa LLC's EtherNet/IP adapter evaluation kit is based on Softing's sample application. Detailed explanations are provided in the Softing documentation which is part of the delivery.

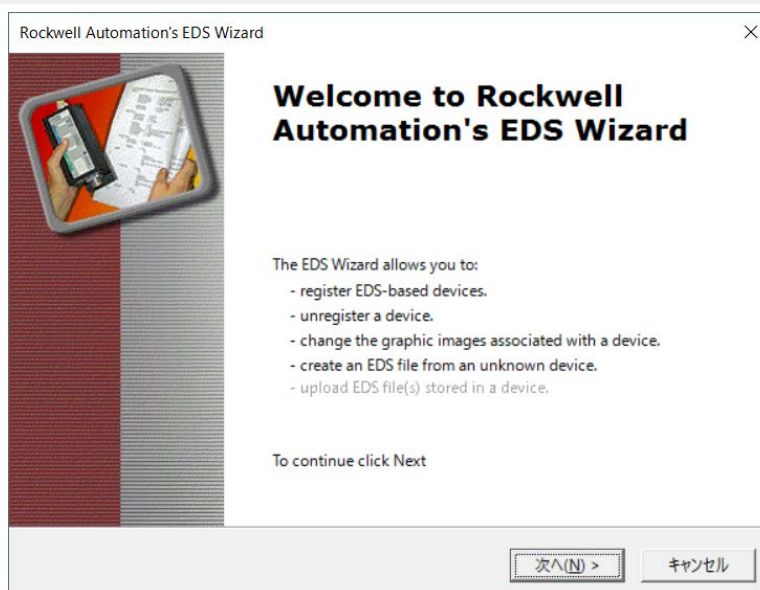
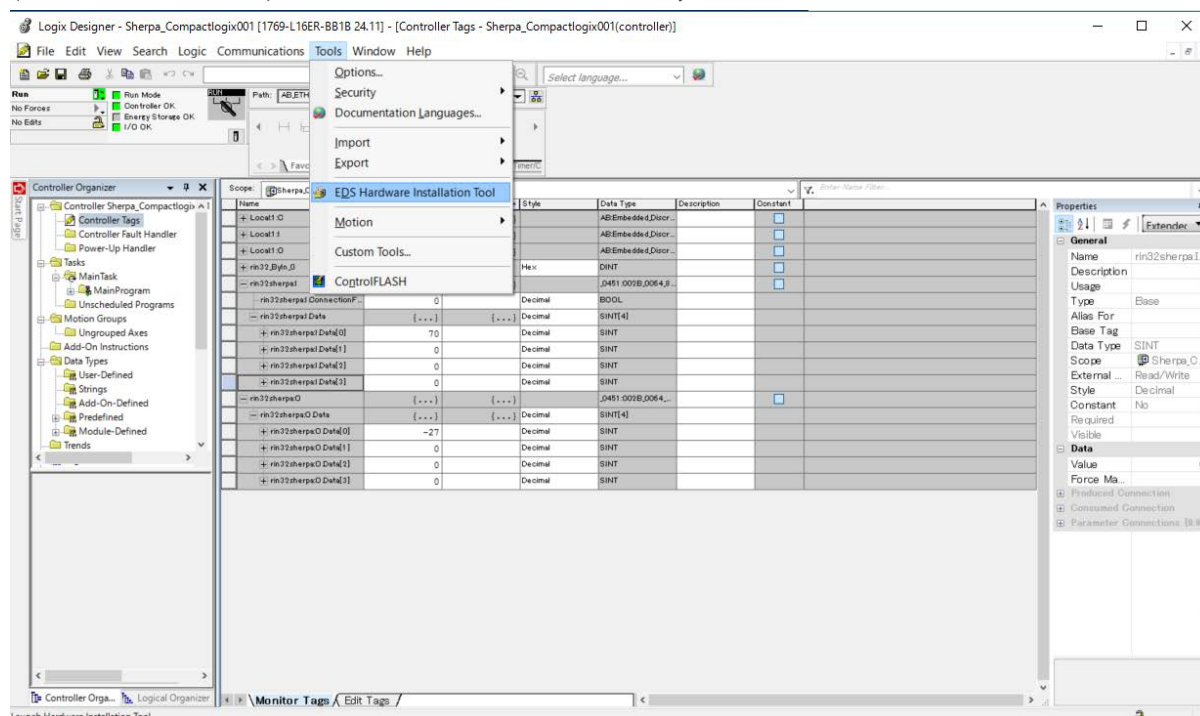
The Softing documentation provided in this delivery is shown below:

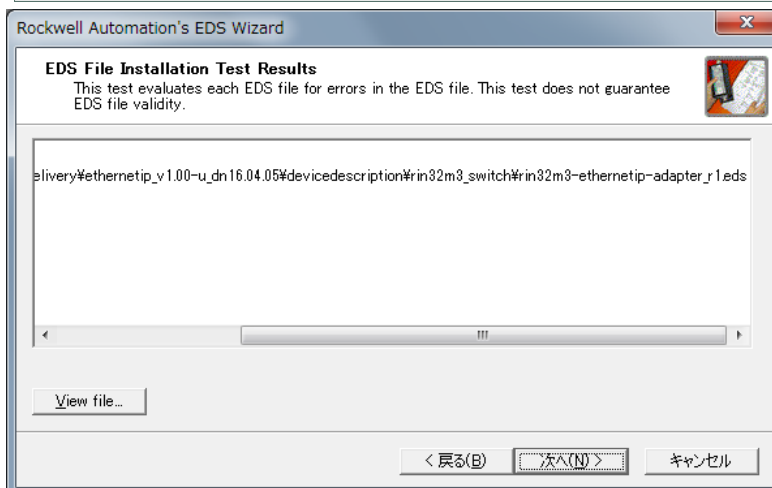
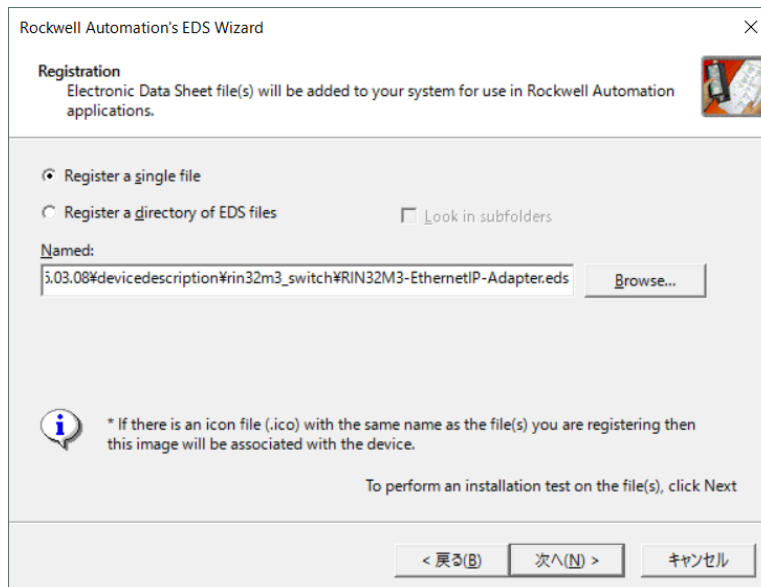
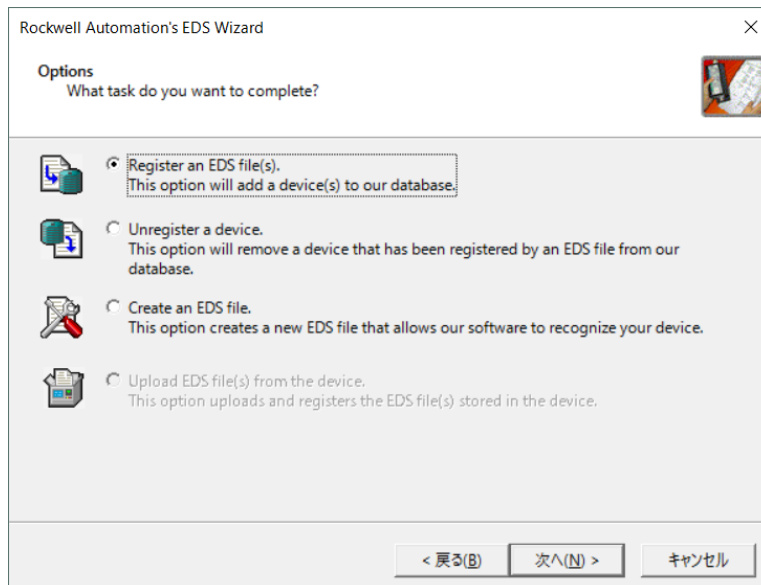


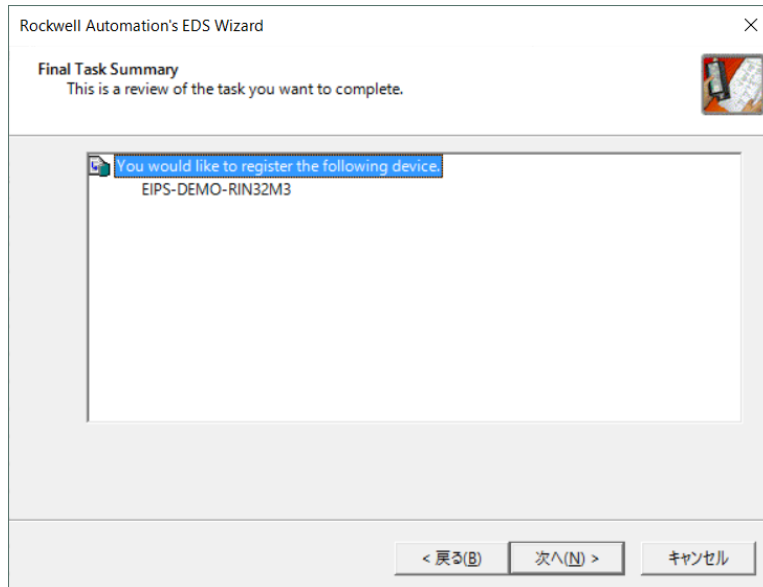
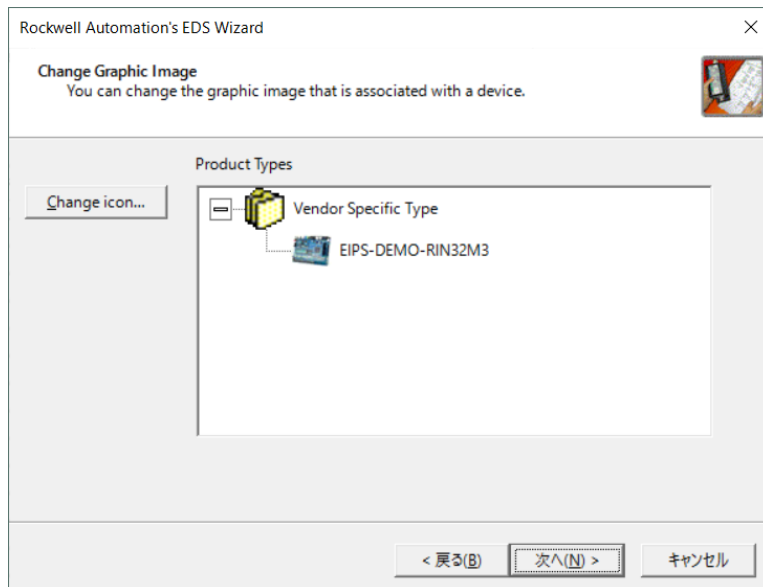
## 11. RSLogix 5000 scanner program and Sherpa EtherNet/IP application

This section provides an overview of the EtherNet/IP scanner program and the Sherpa sample application.

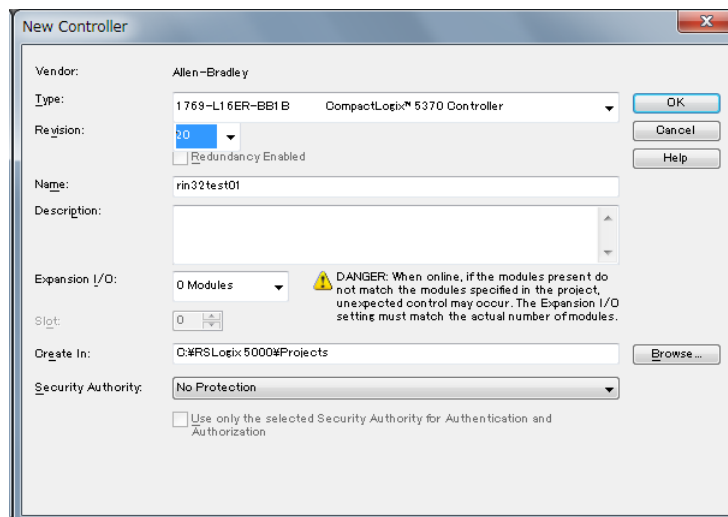
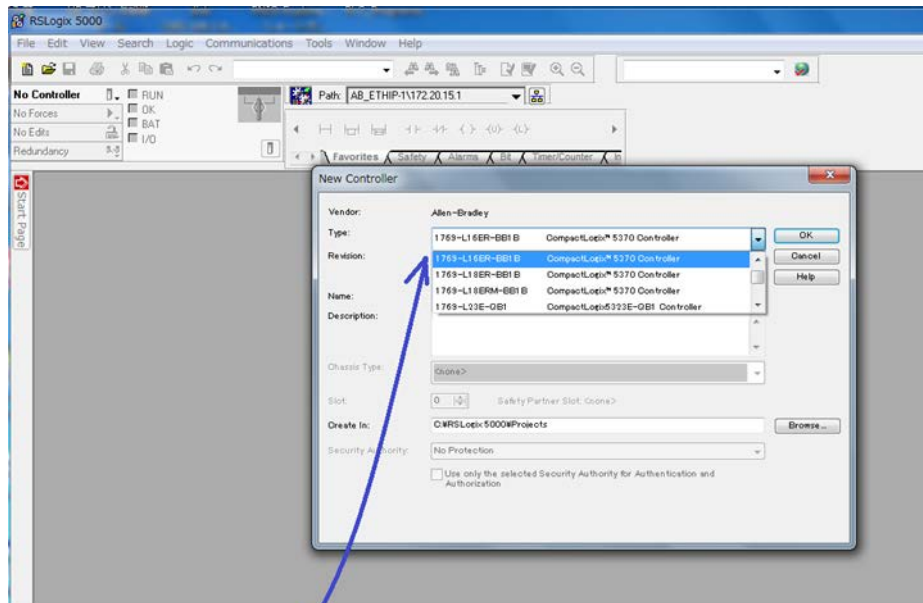
The first time the RSLogix5000 program is used for the Sherpa application, the provided EDS (Electronic Data Sheet) must be installed in the EDS library, as shown below:



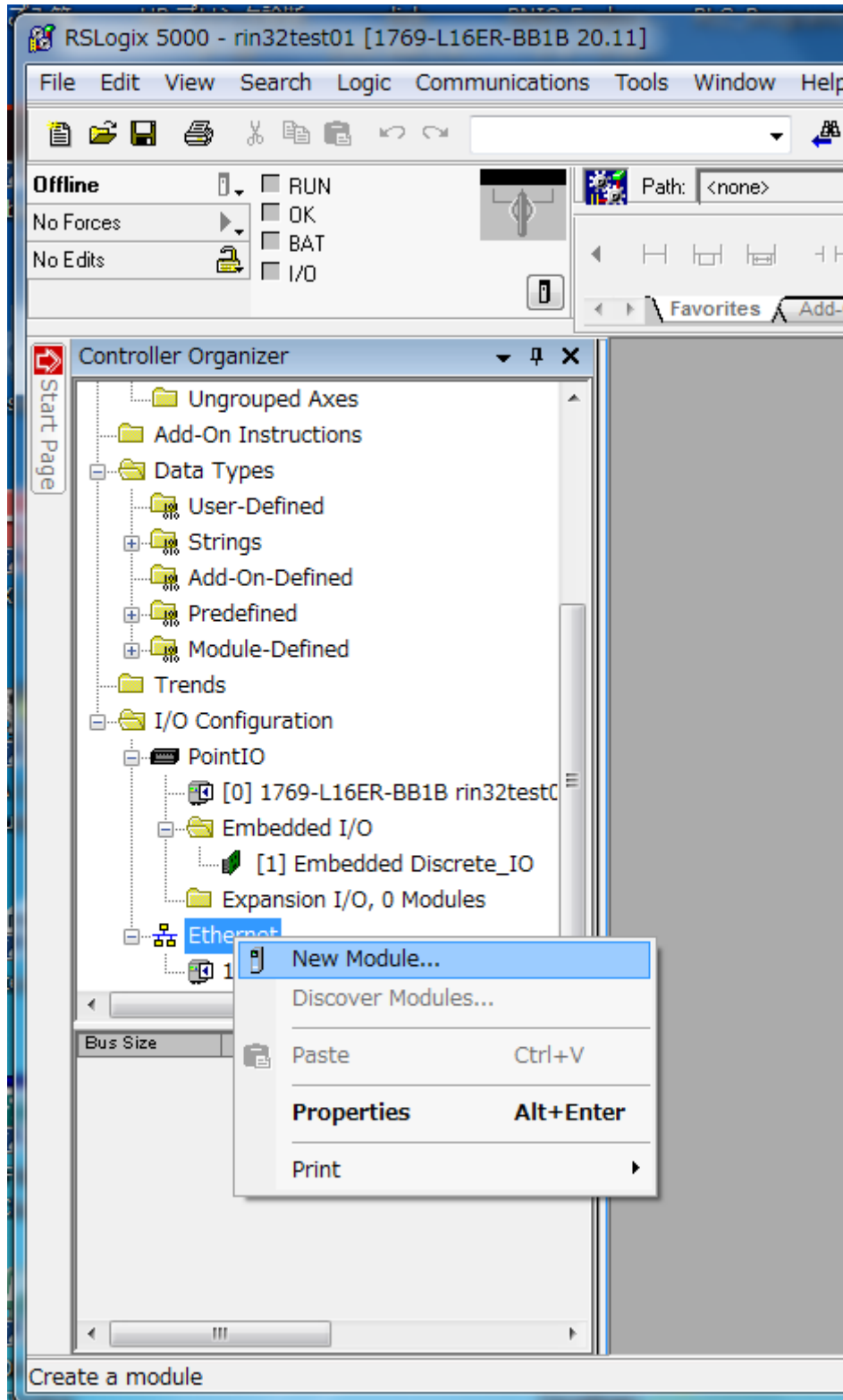




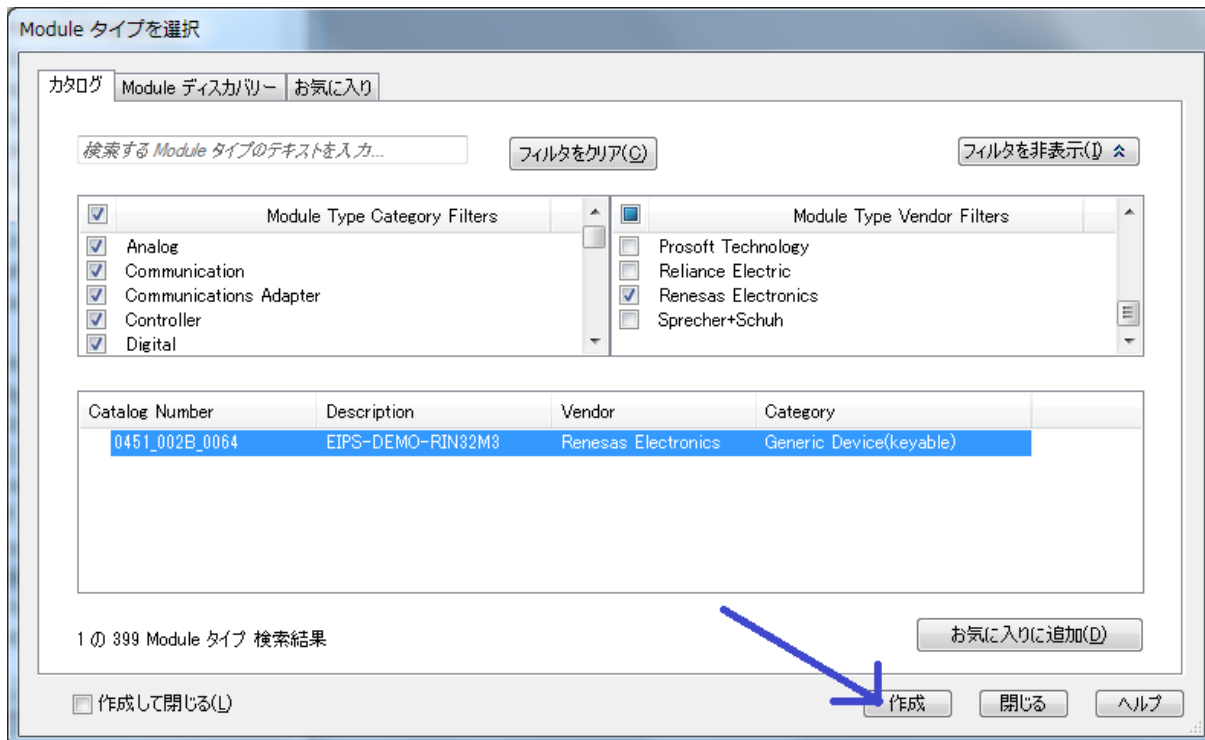
When the RSLogix 5000 project is created from scratch it is necessary to choose in the project the same model of CompactLogix or ControlLogix or whichever processor is being used for the test.



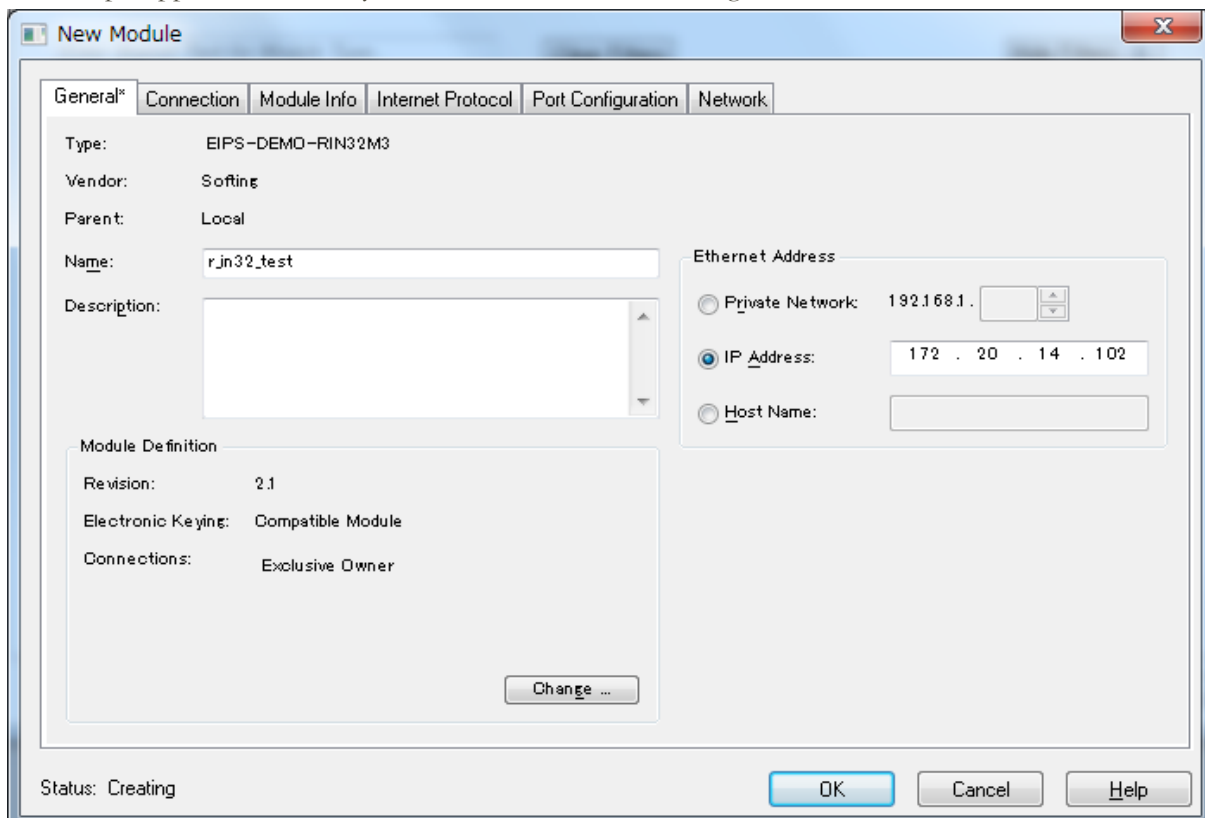
In order to add the r-in32 EtherNet/IP sample application to the IO scan list right-click new module on the Ethernet icon under the I/O configuration folder in the RSLogix 500o project.

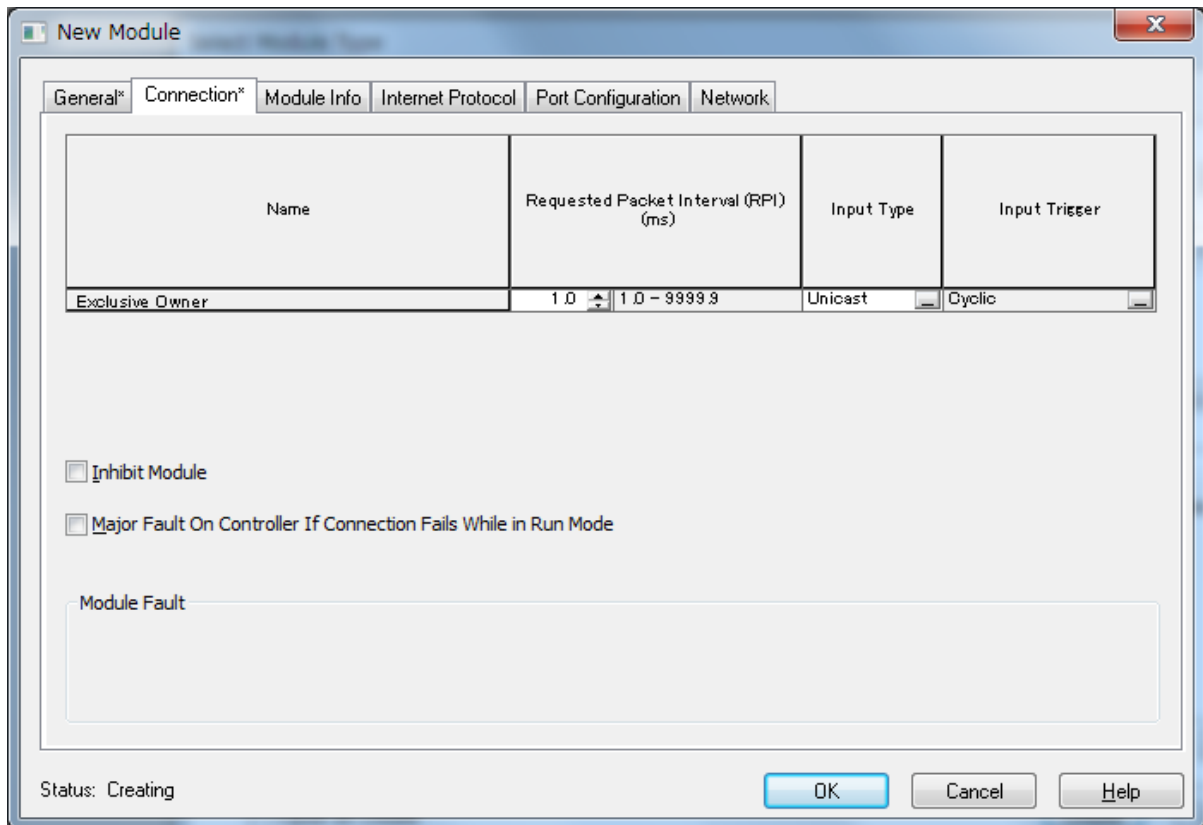
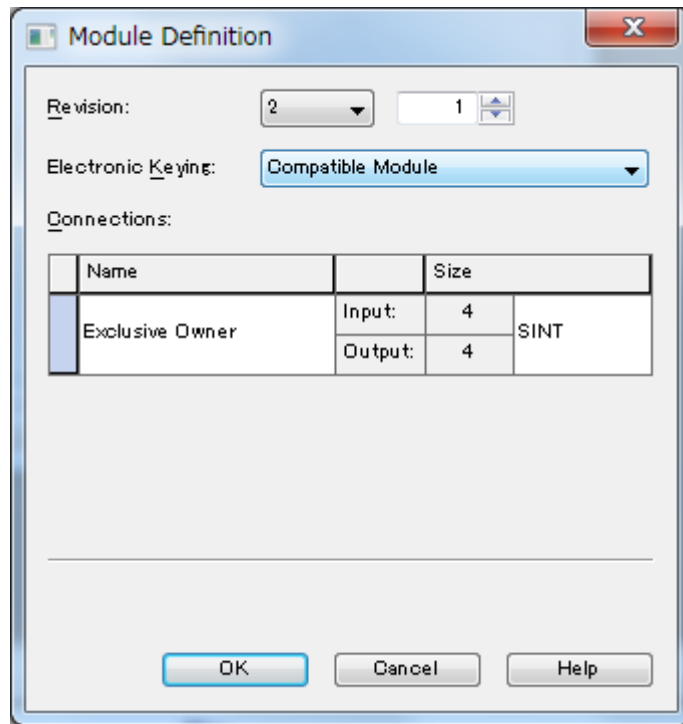


Select the EIPS-DEMO-APPLICATION from the available EDS files in the EDS library by clicking the “Create” button.



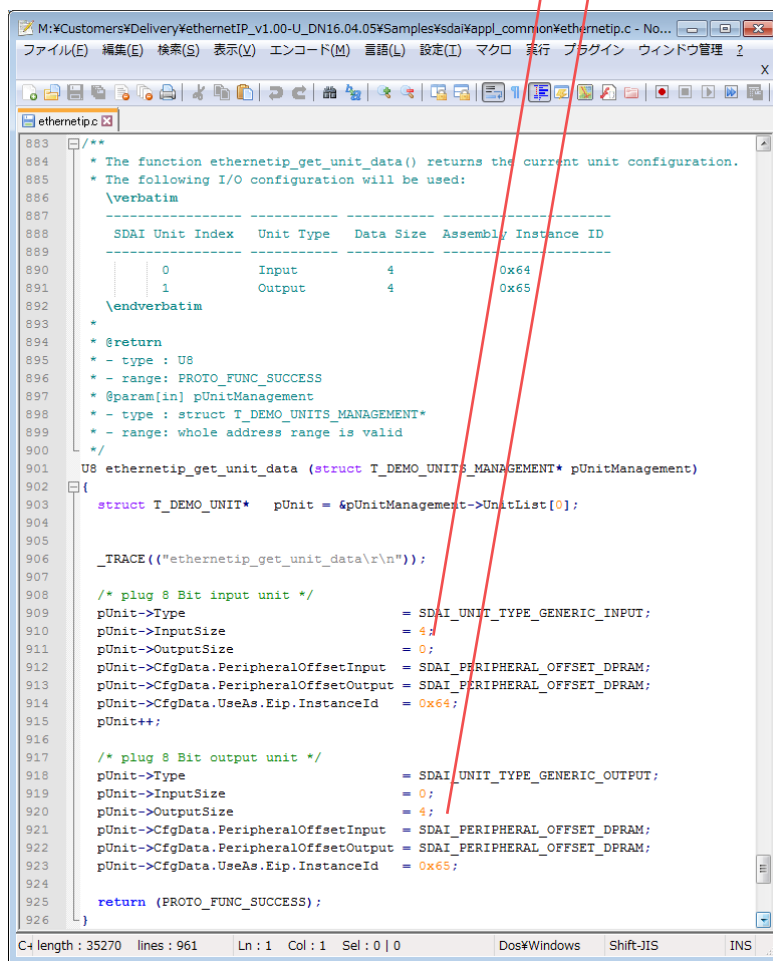
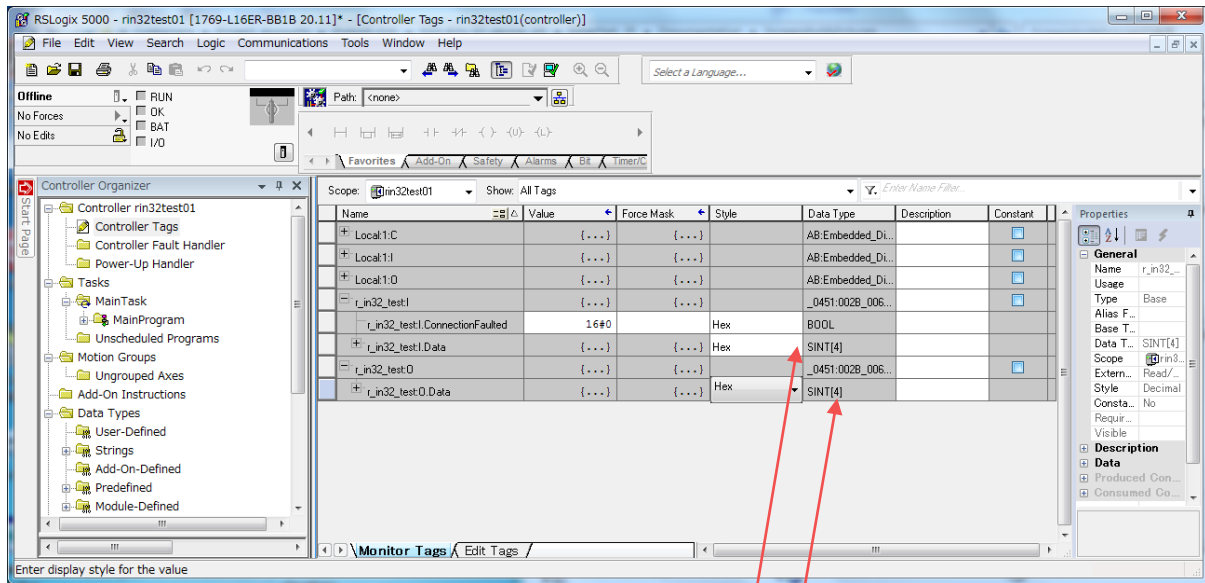
The sample application will only work for the connection settings shown below:





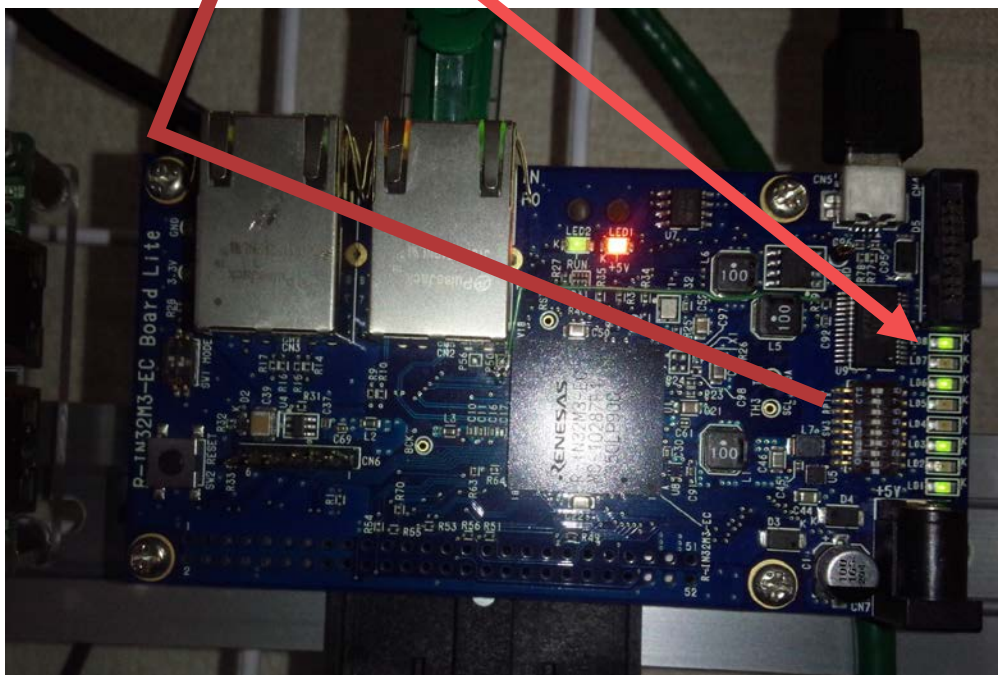
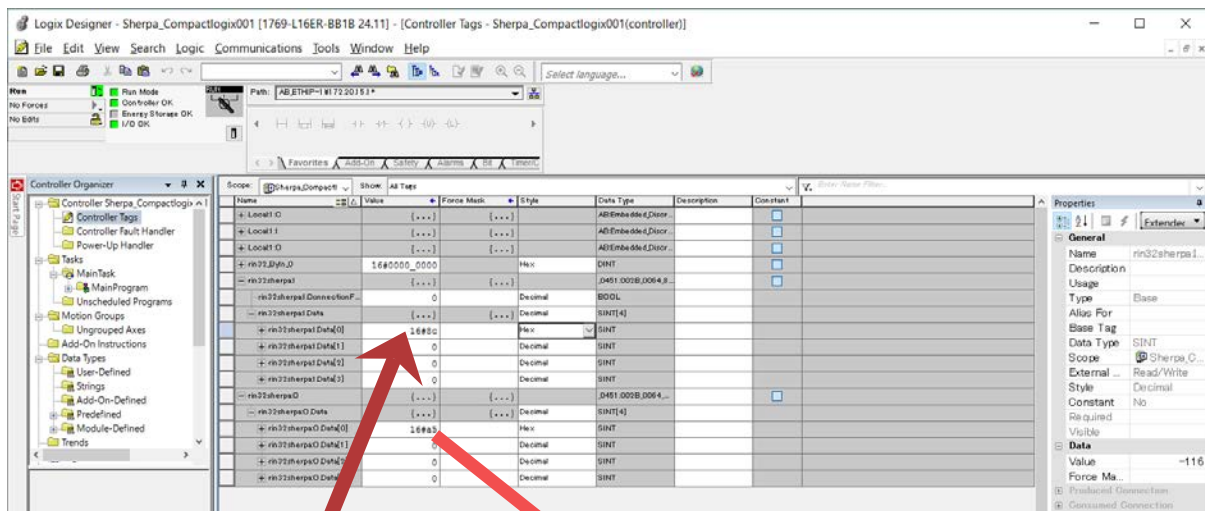


The IO configuration in the EtherNet/IP scanner must correspond to the IO configuration defined in the Sherpa application running on R-IN32M3.



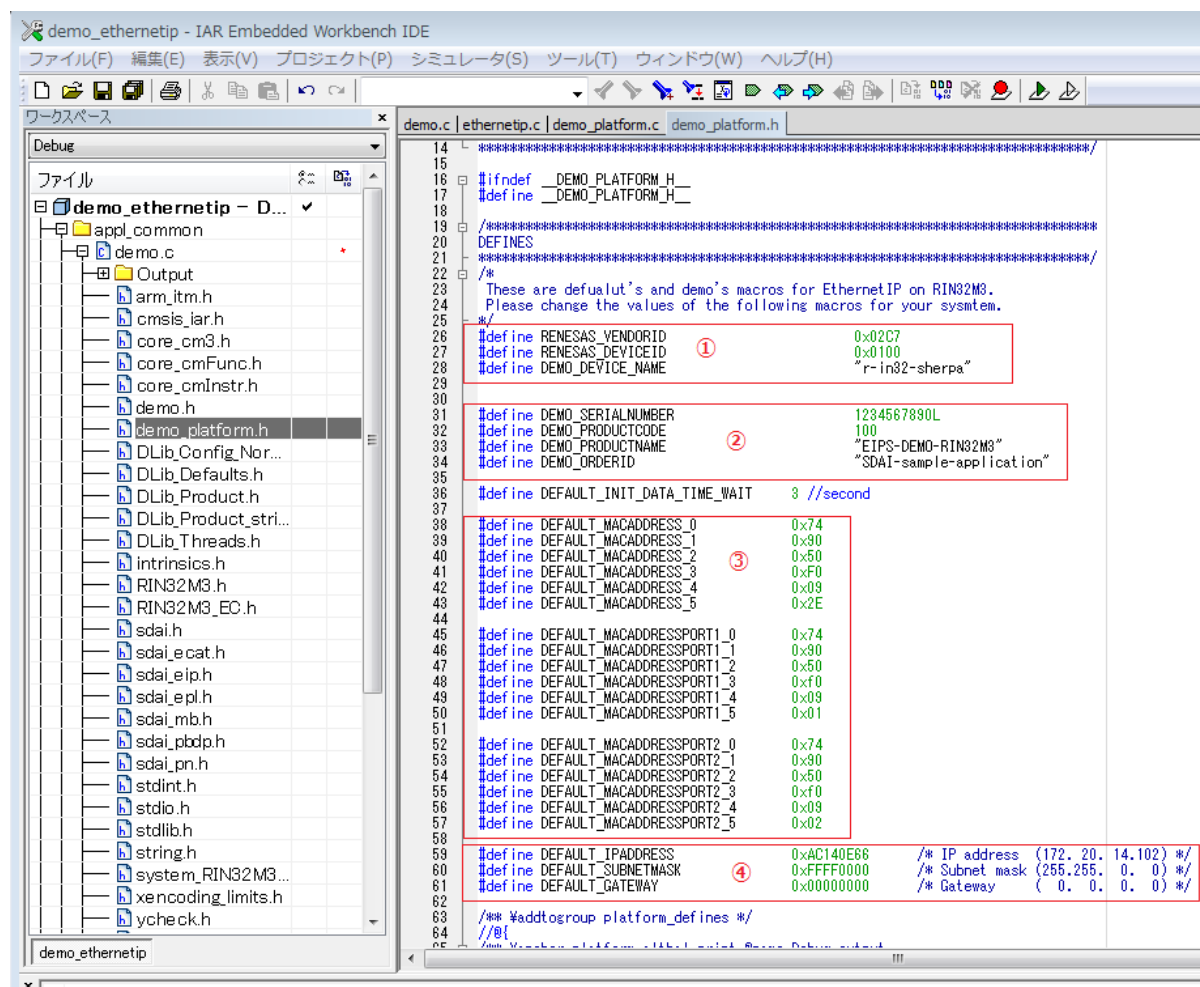
## 12. Sherpa EtherNet/IP application's external interface in IAR System board

This section provides a description for the Sherpa sample EtherNet/IP adapter applications external interface on the IAR System evaluation board. The external interface consist of light emitting diode for output and status representation and DIP switch for input to the EtherNet/IP scanner of Sherpa application operation. Below the R-IN32M32 is shown while communicating with the EtherNet/IP scanner and the IO information is shown simultaneously on the R-IN32M3 and the RSLogix 5000.



## 13. Sample Application Initialization

The initialization for the sample application is described in “demo\_platform.h” header file.



```
14  /******  
15  
16  #ifndef DEMO_PLATFORM_H  
17  #define DEMO_PLATFORM_H  
18  
19  /******  
20  #define  
21  #define  
22  /*  
23  These are default's and demo's macros for EthernetIP on RIN32M3.  
24  Please change the values of the following macros for your system.  
25  */  
26  #define RENESAS_VENDORID 0x02C7  
27  #define RENESAS_DEVICEID ① 0x0100  
28  #define DEMO_DEVICE_NAME "r-in32-sherpa"  
29  
30  
31  #define DEMO_SERIALNUMBER 1234567890L  
32  #define DEMO_PRODUCTCODE 100  
33  #define DEMO_PRODUCTNAME ② "EIPS-DEMO-RIN32M3"  
34  #define DEMO_ORDERID "SDAI-sample-application"  
35  
36  #define DEFAULT_INIT_DATA_TIME_WAIT 3 //second  
37  
38  #define DEFAULT_MACADDRESS_0 0x74  
39  #define DEFAULT_MACADDRESS_1 0x90  
40  #define DEFAULT_MACADDRESS_2 0x50  
41  #define DEFAULT_MACADDRESS_3 ③ 0xF0  
42  #define DEFAULT_MACADDRESS_4 0x09  
43  #define DEFAULT_MACADDRESS_5 0x2E  
44  
45  #define DEFAULT_MACADDRESSPORT1_0 0x74  
46  #define DEFAULT_MACADDRESSPORT1_1 0x90  
47  #define DEFAULT_MACADDRESSPORT1_2 0x50  
48  #define DEFAULT_MACADDRESSPORT1_3 0xf0  
49  #define DEFAULT_MACADDRESSPORT1_4 0x09  
50  #define DEFAULT_MACADDRESSPORT1_5 0x01  
51  
52  #define DEFAULT_MACADDRESSPORT2_0 0x74  
53  #define DEFAULT_MACADDRESSPORT2_1 0x90  
54  #define DEFAULT_MACADDRESSPORT2_2 0x50  
55  #define DEFAULT_MACADDRESSPORT2_3 0xf0  
56  #define DEFAULT_MACADDRESSPORT2_4 0x09  
57  #define DEFAULT_MACADDRESSPORT2_5 0x02  
58  
59  #define DEFAULT_IPADDRESS 0xAC140E88 /* IP address (172. 20. 14.102) */  
60  #define DEFAULT_SUBNETMASK ④ 0xFFFF0000 /* Subnet mask (255.255. 0. 0) */  
61  #define DEFAULT_GATEWAY 0x00000000 /* Gateway ( 0. 0. 0. 0) */  
62  
63  /*# Yaddtogroup platform_defines */  
64  /*# Yaddtogroup platform_init_data_defines */  
65  /*# Yaddtogroup platform_init_data_defines */
```

There are four sections of this file that must be modified to customize an application. The explanation below elaborate further on the changes required for “demo\_platform.h” header file.

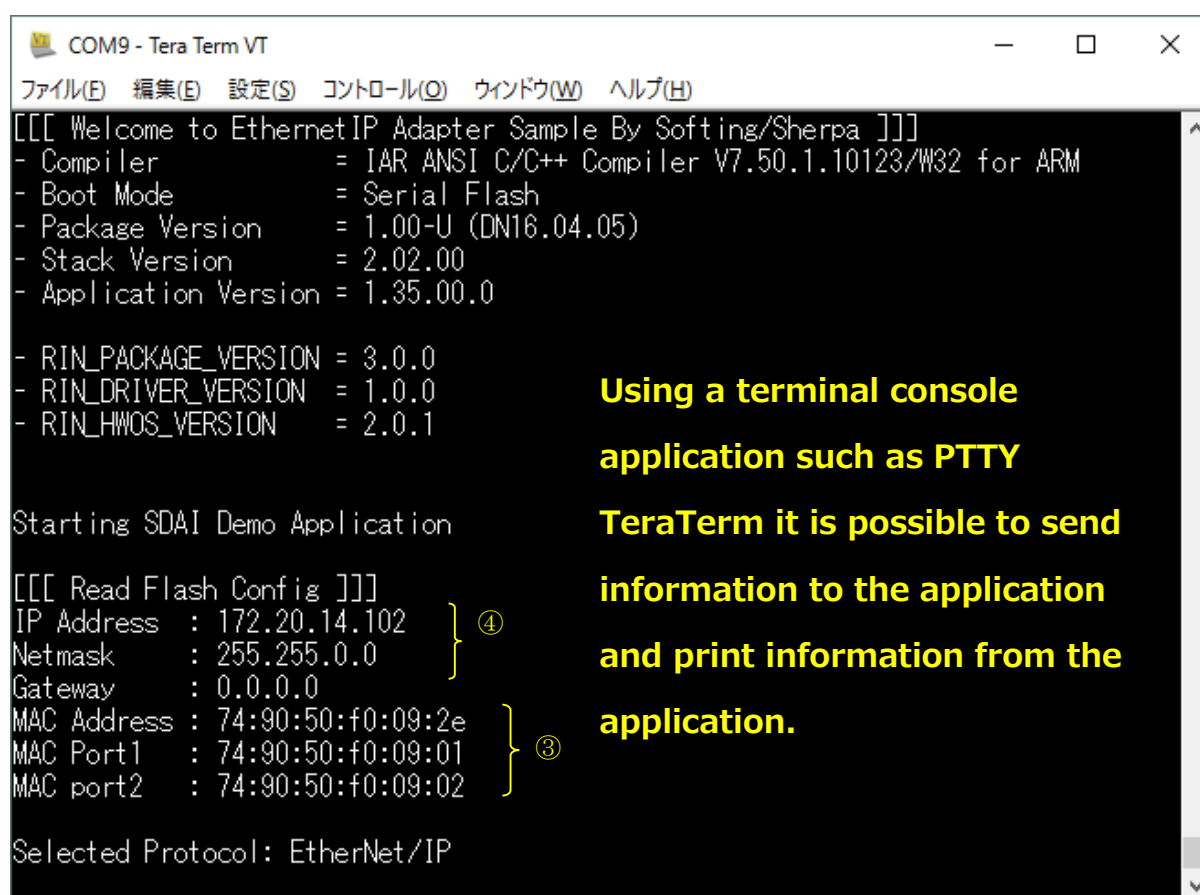
- (1) Changes related to the device identity:  
The “RENESAS\_VENDORID” is a value assigned by ODVA. In order to use a different vendor ID in the application this code must be modified. The value programmed on the SDAI application must be identical to the vendor ID used in the EDS file with which the EtherNet/IP scanner is programmed. For testing purposes the value provided in the sample application and the EDS file provided by the package can be used.
- (2) Values related to demo product. These values will need to be modified and matched to the customized EDS when developing an actual product. For the purpose of testing the values provided in the sample application and the EDS provided can be used.
- (3) MAC address:  
The MAC address used in the application has been provided by Renesas Corporation. When developing an actual product the MAC address must be determined by standard rules.

(4) IP address:

The IP address should be corrected for the actual application.

It is also possible to modify the above values at runtime using a terminal console application which should be set to the below communication parameters.

Baud rate: 115200  
Data bits: 8bit  
Parity: none  
Stop-bit: 1bit  
Flow control: none



When the Ethernet/IP device stack application runs on the R-IN32M3 evaluation board for the first time the values shown in the above screenshot are written to the flash ROM of R-IN32M3 on the evaluation board, and the application will start with those values.

In order to be able to use values other than those programmed in “demo\_platform.h” file, before the counter shown in below screenshot becomes zero, press any key to start a menu option to modify these values.

```
[[[ Welcome to EthernetIP Adapter Sample By Softing/Sherpa ]]]
- Compiler      = IAR ANSI C/C++ Compiler V7.50.1.10123/W32 for ARM
- Boot Mode     = Serial Flash
- Package Version = 1.00-U (DNT6.04.05)
- Stack Version  = 2.02.00
- Application Version = 1.35.00.0

- RIN_PACKAGE_VERSION = 3.0.0
- RIN_DRIVER_VERSION  = 1.0.0
- RIN_HWOS_VERSION    = 2.0.1

1
Do you erase the flash area? (y/n) : y
Erase data to flash!
```

If “y” is selected in the above menu the following menu will allow the programming of different values.

- IP Address, Netmask, Gateway
- MAC Address, Mac Port1 Address, Mac Port2 Address
- Wait Count (Number of seconds for count down before boot)

```
- RIN_PACKAGE_VERSION = 3.0.0
- RIN_DRIVER_VERSION  = 1.0.0
- RIN_HWOS_VERSION    = 2.0.1

1
Do you erase the flash area? (y/n) :
Do you change IP Address? [172.20.14.102] (y/n) :
Do you change Netmask? [255.255.0.0] (y/n) :
Do you change Gateway? [0.0.0.0] (y/n) :
Do you change MAC Address? [74:90:50:f0:09:2e] (y/n) :
Do you change MAC Port1? [74:90:50:f0:09:01] (y/n) :
Do you change MAC Port2? [74:90:50:f0:09:02] (y/n) :
Do you change Boot Wait Count (Second)? [3] (y/n) :

IP Address   : 172.20.14.102
Netmask      : 255.255.0.0
Gateway      : 0.0.0.0
MAC Address  : 74:90:50:f0:09:2e
MAC Port1    : 74:90:50:f0:09:01
MAC Port2    : 74:90:50:f0:09:02
Wait Count   : 3
Are you sure? (y/n) : y
```

Press “y” at the end to get the values programmed into flash ROM.

## 14. Licensing, product development and additional services

The Sherpa LLC's EtherNet/IP adapter evaluation kit allows industrial device manufacturers to develop devices that conform to the EtherNet/IP standard in a very short time and with minimum involvement in the communication protocol management, which is done by the Sherpa library. The use of this library in production requires a licensing contract between the device manufacturer and Sherpa LLC. When this agreement is reached Sherpa will provide release library customized to the vendor's specific board. Customization services can include access library porting to external application processor when R-IN32M3 is used as a communication co-processor. Additionally, consulting services for measurement application development can be considered as part of consulting services package.

For information about licensing and consulting services, please contact Sherpa LLC at:

Sherpa LLC  
Office #8, 3<sup>th</sup> floor, Kase Building 88  
3-19-11 Shin-Yokohama, Kohoku-ku,  
Yokohama, Kanagawa Prefecture, Japan, 222-0033  
TEL 050-5532-6257  
r-in32-stack@sherpa-tech.jp

## 15. EtherNet/IP adapter stack functionality

Cycle Time	1 ms
Device-Level Ring	Slave hardware functionality
I/O Data	505 Bytes output, 509 Bytes input
Number of I/O Connections	10 (default; configurable depending on available socket resources)
Number of Encapsulation Sessions	10 (default; configurable depending on available socket resources)Number of Explicit Messaging
Connections	2 explicit messaging connections per encapsulation session (20 explicit messaging connections in total, configurable)
Number of User-Specific Objects	Unlimited
Maximum Number of Connections	2 explicit messaging connections x 10 encapsulation sessions + 10 I/O connections (30 connections) > Identity > Message Router (with implemented functionality) > Up to 32 Assemblies > Connection Manager
Predefined Standard Objects	> Device Level Ring > Quality of Service > TCP/IP Interface > Ethernet Link