iVu Plus Industrial Ethernet

Instruction Manual

Original Instructions
B_3095133 Rev. D
26 January 2015

BANNER®

Contents

1 Device Setup

1.1 Set IP Address

When shipped, the device is assigned a default IP address - 192.168.0.1, a default Subnet Mask - 255.255.255.0, and a default gateway - 0.0.0.0. To change these defaults, click on Main Menu > System > Communications > Ethernet I/O.

1.2 Set Industrial Ethernet Protocol (EIP/Modbus/TCP/PCCC)

The Industrial Ethernet communication channel is disabled by default. In order to enable this channel, click on Main Menu > System > Communications > Industrial Ethernet > Connection. Select the channel of interest (EIP, Modbus/TCP or PCCC). Only one type of connection can be established at any given time.

Information about an established connection can be obtained from Main Menu > System > Communications > Industrial Ethernet > Status screen. Click on the connection of interest to view details.

This device provides extensive logging for the communication that occurs over the Industrial Ethernet connection. Logs can either be viewed from Main Menu > System > Communications > Industrial Ethernet > View Logs, or Main Menu > Logs > Communication Logs > Industrial Ethernet.

1.3 Set Trigger Mode

The sensor can be triggered using either the hardware trigger or through over the Industrial EtherNet. In order to only accept triggers generated through the Industrial EtherNet communication channel, click on the Main Menu > Imager > Trigger, and select Industrial EtherNet Only from the drop-down menu.

2 Supported Functions

The iVu Plus Series sensor is controlled over EtherNet/IP and Modbus/TCP using the input and output data it makes available as a slave device for those protocols.

Here are some of the Sensor operations that can be performed using input and output values:

- Product Change
- Teach Enable
- Trigger the sensor
- Read output indicators (pass/fail/ready/error)
- Read counters (pass, fail, system error, missed trigger, frame count, iteration count)
- Read iVu sensor results
- On Barcode, change compare string and its mask

2.1 iVu Input Values

The operation of the iVu Plus Series sensor can be controlled through input bits and commands.

Register/Input Coil Bits

The following commands can only be executed using bits:

Input Coil Bit	Command	Description
0	Product Change	Execute a product change (inspection number specified in the "Product Change Number" 32-bit integer register).
1	Teach Latch	Latch a teach flag. Teach is executed on next trigger.
2	Trigger	Causes system to trigger an inspection if ready.
3	Gated Trigger	Causes system to start looking for requested barcodes (BCR products only)
5	Set BCR String	Sets barcode compare string (BCR products only)
6	Set BCR Mask	Sets masks for barcode compare string (BCR products only)
15	Command	Set this bit to 1 to execute the command entered in the Command ID Register.

2.2 iVu Output Values

Using output values, the following information can be obtained:

- ACK bits (acknowledgement bits) for input commands, including error codes
- System indicators (Ready, Pass/Fail, Read/No Read, Output signals, Command Error, etc.)
- Inspection History (Iteration Count, Pass Count, Fail Count, etc.)
- Current Inspection Results (data of the sensor type contained in the inspection)
- Command Responses

Refer to the sections on protocols for more information.

2.2.1 ACK Flags

For each of the Command Flags there is a corresponding ACK flag. The Vision Sensor sets the ACK flag when the corresponding action is complete. Command flags cause actions to occur on the low-to-high transition of that flag. You must clear the command flag after the corresponding ACK flag has been observed to be high.

As an example, to use the Trigger ACK flag, the programming steps for triggering an inspection would be:

1. Wait for ready.
2. Set Trigger command flag to 1.
3. Wait for Trigger ACK to go to 1.
4. Set Trigger command flag to 0.

2.2.2 Command Responses

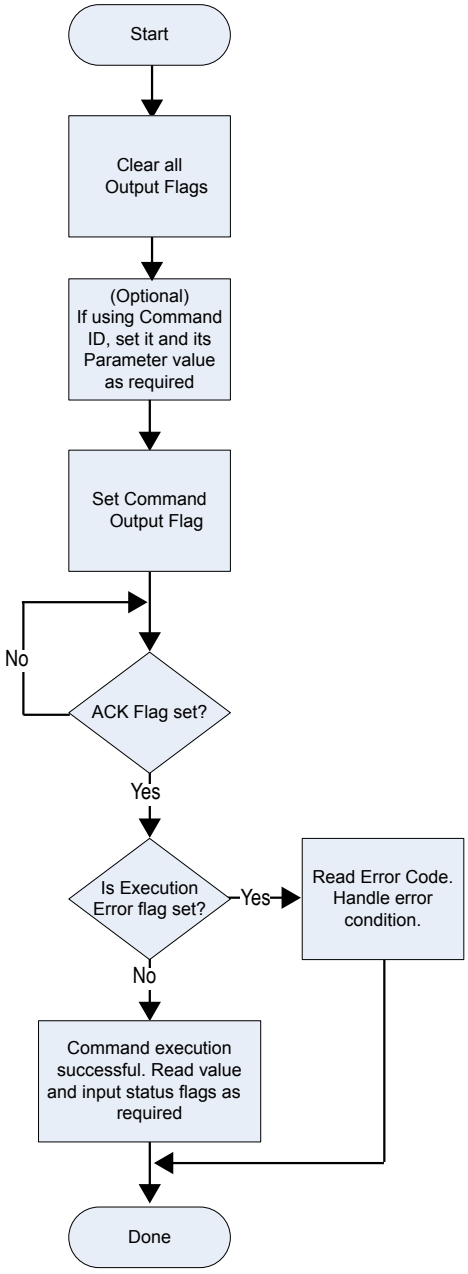
iVu Plus Series Command Channel commands executed using command IDs may have a response value. Depending on the Data Type, the response value will be contained in one or multiple registers. Refer to iVu Command Channel Commands section of this document and the iVu Plus Communication's Users Guide for more information about the iVu Command Channel.

3 Sensor Operation

Any Industrial Ethernet protocol can be used to trigger inspections, remote teach and perform command functions. On iVuPlus BCR models, compare strings can also be set.

3.1 General Command Execution

Point of View of PLC



Following rules apply for the usage of input bit commands:

- Only one output bit can be set at a time.
- Corresponding ACK bits are only set high on completion of the command (if output bit is still high).
- Corresponding ACK bits are cleared when the output bit is cleared.
- When multiple output bits are set simultaneously, the Execution Error input bit is set and an Error Code value is reported on the input register.
- The Execution Error input bit is cleared when all ACK bits get cleared, or a new valid command is received.

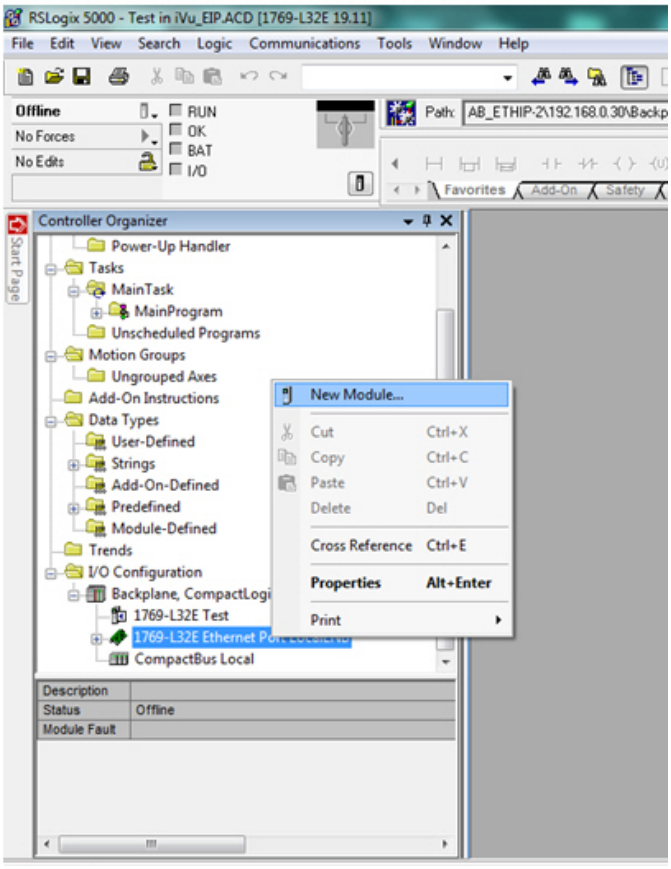
4 EtherNet / IP

The iVu Plus device is controlled by a ControlLogix PLC using assembly objects. From the point-of-view of a PLC, there are three input assemblies and two output assemblies.

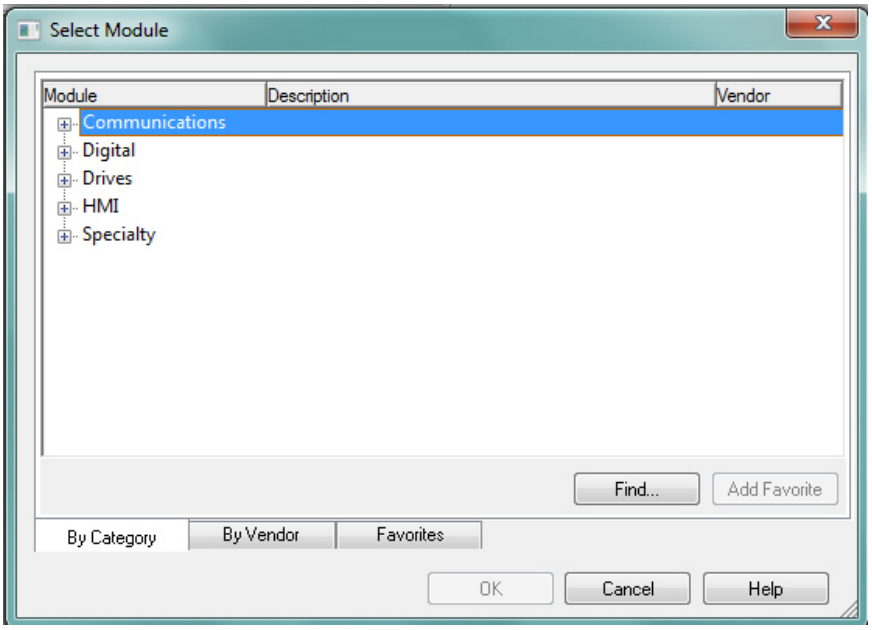
4.1 RSLogix5000 Configuration

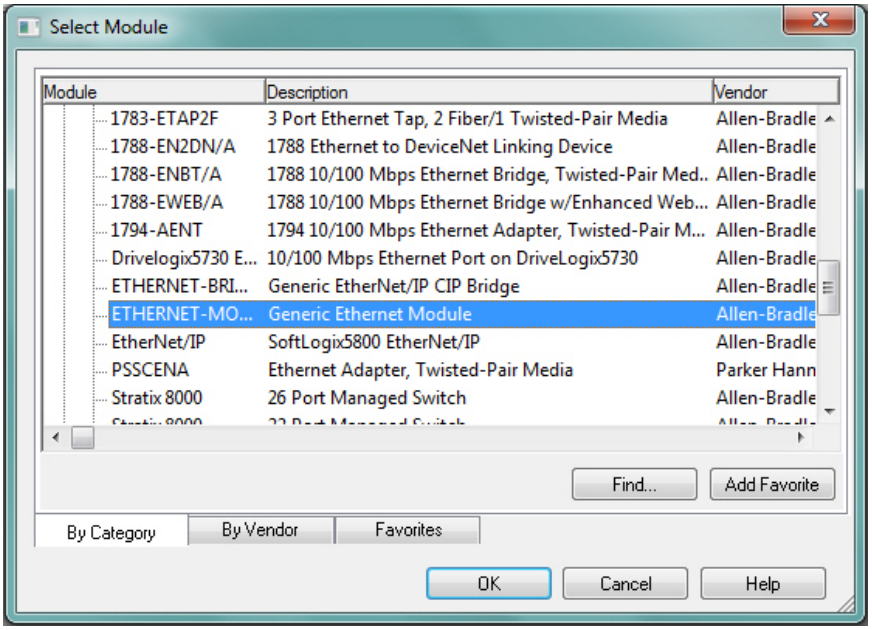
To create an implicit Class 1 configuration to the iVu Plus using EIP when using a ControlLogix family PLC, configure the iVu Plus as a “Generic Ethernet Module” under the ENET_MODULE. The following is a sample setup of Banner sensor:

1. Add a generic Ethernet module to the PLC's Ethernet card.



2. Select Module.





3. Configure Module Properties.

NOTE: The data type in the Comm Format must be changed to an INT.

See *Inputs to iVu (Outputs from PLC)* on page 13 and *Outputs from the iVu (Inputs to the PLC)* on page 14 for more information on each specific assembly instance.

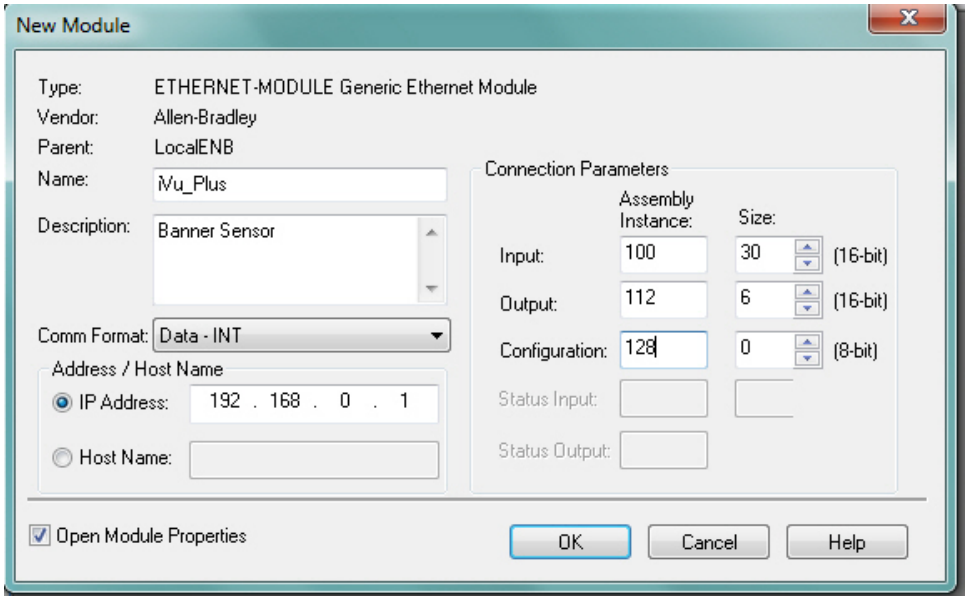


Figure 1. PLC Input Assembly (100), PLC Output Assembly (112)

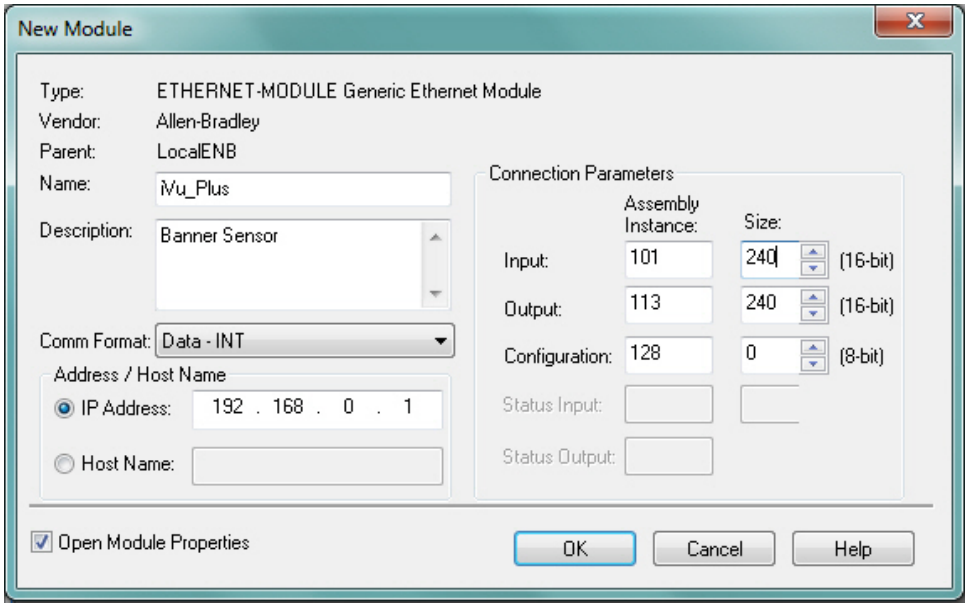


Figure 2. PLC Input Assembly (101), PLC Output Assembly (113)

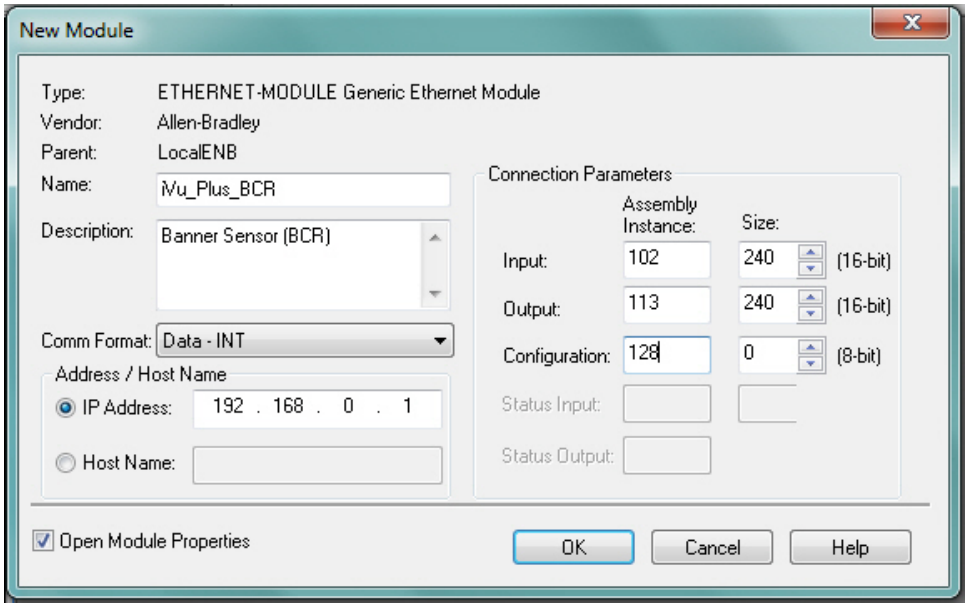


Figure 3. iVu Plus BCR—PLC Input Assembly (102), PLC Output Assembly (113)

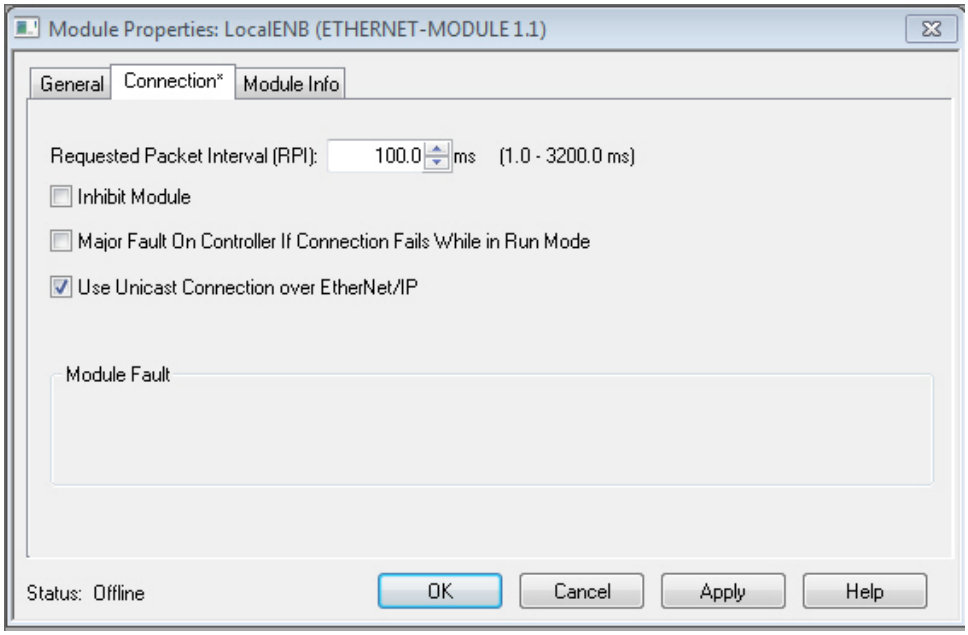
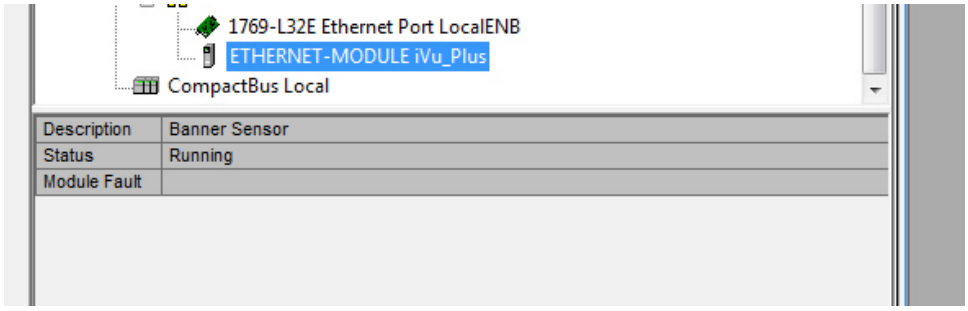


Figure 4. Select or deselect Unicast Connection as desired

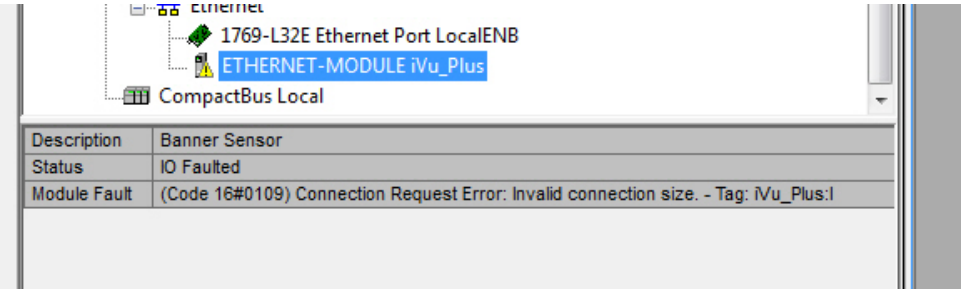
NOTE: The minimum allowed RPI is 50 ms.

4. If the module configuration was successful, the following information should be displayed:

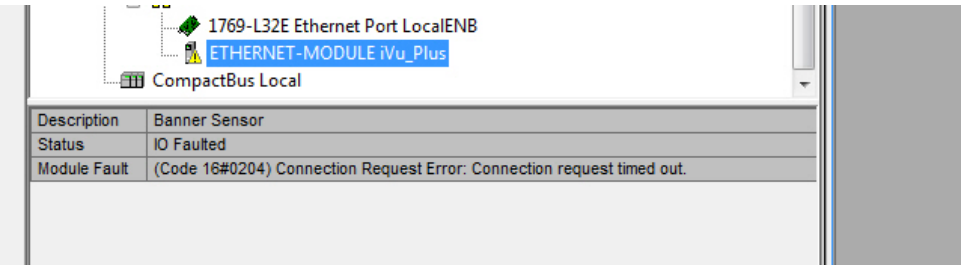


If the module configuration was not successful, the RSLogix 5000 software will indicate errors similar to the ones displayed below:

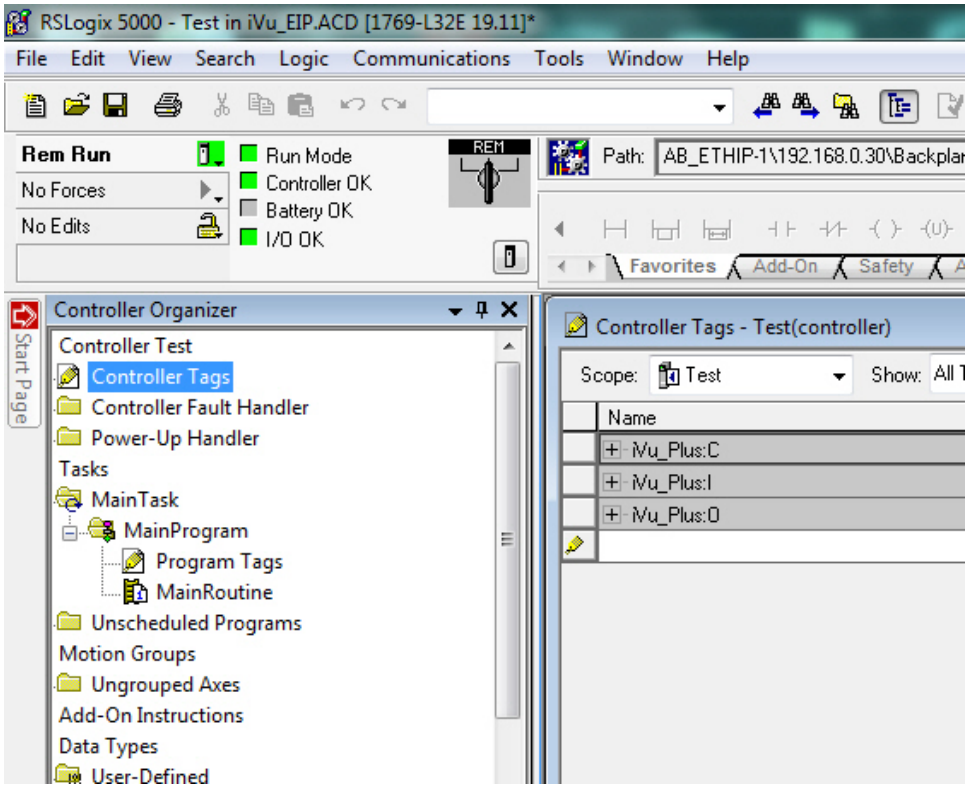
- ERROR: Assembly Instance number and/or size incorrect.



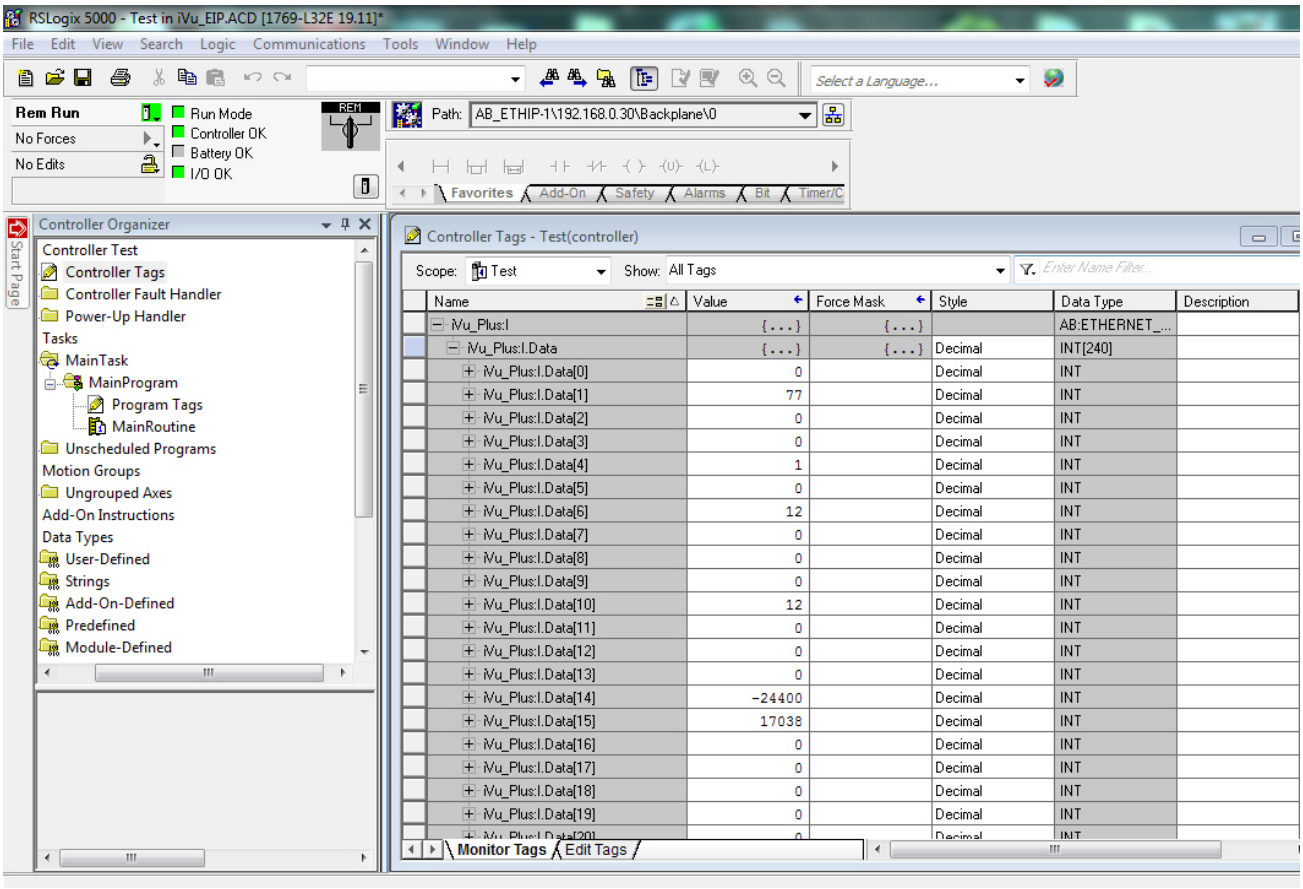
- ERROR: iVu Plus not powered up or EtherNet cable not attached.



5. Locate the memory map setup from Banner module to PLC memory map.



C = Configuration (not used)
I = Inputs to PLC (outputs from iVu Plus)
O = Outputs from PLC (inputs to iVu Plus)



The iVu Plus memory map expanded. I = Inputs to PLC (outputs from iVu Plus).

Sample map demonstrating string values:

iVu_Plus:I.Data[55]	1		Decimal	INT
iVu_Plus:I.Data[56]	1		Decimal	INT
iVu_Plus:I.Data[57]	1		Decimal	INT
iVu_Plus:I.Data[58]	20		Decimal	INT
iVu_Plus:I.Data[59]	20		Decimal	INT
iVu_Plus:I.Data[60]	0		Decimal	INT
iVu_Plus:I.Data[61]	22121		Decimal	INT
iVu_Plus:I.Data[62]	20597		Decimal	INT
iVu_Plus:I.Data[63]	30060		Decimal	INT
iVu_Plus:I.Data[64]	8307		Decimal	INT
iVu_Plus:I.Data[65]	27977		Decimal	INT
iVu_Plus:I.Data[66]	26465		Decimal	INT
iVu_Plus:I.Data[67]	8293		Decimal	INT
iVu_Plus:I.Data[68]	25939		Decimal	INT
iVu_Plus:I.Data[69]	29550		Decimal	INT
iVu_Plus:I.Data[70]	29295		Decimal	INT

Figure 5. Memory Map: Default

NOTE: ControlLogix string format. "iVu Plus Image Sensor"

⊞ iVu_Plus:I.Data[55]	1		Decimal	INT
⊞ iVu_Plus:I.Data[56]	1		Decimal	INT
⊞ iVu_Plus:I.Data[57]	1		Decimal	INT
⊞ iVu_Plus:I.Data[58]	20		Decimal	INT
⊞ iVu_Plus:I.Data[59]	20		Decimal	INT
⊞ iVu_Plus:I.Data[60]	0		Decimal	INT
⊞ iVu_Plus:I.Data[61]	'Vi'		ASCII	INT
⊞ iVu_Plus:I.Data[62]	'Pu'		ASCII	INT
⊞ iVu_Plus:I.Data[63]	'ul'		ASCII	INT
⊞ iVu_Plus:I.Data[64]	' s'		ASCII	INT
⊞ iVu_Plus:I.Data[65]	'mI'		ASCII	INT
⊞ iVu_Plus:I.Data[66]	'ga'		ASCII	INT
⊞ iVu_Plus:I.Data[67]	' e'		ASCII	INT
⊞ iVu_Plus:I.Data[68]	'eS'		ASCII	INT
⊞ iVu_Plus:I.Data[69]	'sn'		ASCII	INT
⊞ iVu_Plus:I.Data[70]	'ro'		ASCII	INT

All data is initially transferred as "INT" data type. An ASCII string looks like gibberish in this format. Changing the "style" to ASCII instead of "Decimal" reveals the correct string data.

Figure 6. Memory Map: "Style" changed to ASCII

4.2 Inputs to iVu (Outputs from PLC)

4.2.1 PLC Assembly Instance 0x70 (112) - 6 Registers (iVu Inputs/PLC Outputs)

WORD #	WORD NAME	DATA TYPE
0	Input Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1-2	Product Change Number	32-bit integer
3-5	*reserved*	

4.2.2 PLC Assembly Instance 0x71 (113) - 240 Registers (iVu Inputs/PLC Outputs

WORD #	WORD NAME	DATA TYPE
0	Inputs Bit Register (see *Input and Output Flags Bits* on page 25	16-bit integer
1-2	Product Change Number	32-bit integer
3-49	*reserved*	32-bit integer
50	Command ID	16-bit integer
51	Command Parameter Int16	16-bit integer
52-53	Command Parameter Int32	32-bit integer
54-55	Command Parameter Float	Float
56-57	String Length	32-bit integer
58-107	String Parameter	100 Byte Array
108	*reserved*	16-bit integer
109-110	Barcode String/Mask Length	32-bit integer
111-210	Barcode String/Mask	200 Byte Array
211-239	*reserved*	

4.3 Outputs from the iVu (Inputs to the PLC)

4.3.1 PLC Assembly Instance 0x64 (100) - 30 Registers (iVu Outputs/PLC Inputs)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor P/F Coil	
17-29	*reserved*	

4.3.2 PLC Assembly Instance 0x65 (101) - 240 Registers (iVu Outputs/PLC Inputs)

Table 1: Sensor Type - Area (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Area Count	32-bit integer
58-59	Area Range Min	32-bit integer
60-61	Area Range Max	32-bit integer
62-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 2: Sensor Type - Blemish (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Blemish Count	32-bit integer
58-59	Blemish Min Edge Length	32-bit integer
60-61	Blemish Max Edge Length	32-bit integer
62-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 3: Sensor Type - Match (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Match Count	32-bit integer
58	Match Min Percent Match	16-bit integer
59	Match Max Percent Match	16-bit integer
60-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 4: Sensor Type - Sort (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56	Sort Pattern Map	16-bit integer
57	Sort Pattern Count	16-bit integer
58	Sort Pattern 1 Count	16-bit integer
59	Sort Pattern 2 Count	16-bit integer
60	Sort Pattern 3 Count	16-bit integer
61	Sort Pattern 4 Count	16-bit integer
62	Sort Pattern 5 Count	16-bit integer
63	Sort Pattern 6 Count	16-bit integer
64	Sort Pattern 7 Count	16-bit integer
65	Sort Pattern 8 Count	16-bit integer
66	Sort Pattern 9 Count	16-bit integer
67	Sort Pattern 10 Count	16-bit integer
68	Sort Min Percent Match	16-bit integer
69	Sort Max Percent Match	16-bit integer
70-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 5: Sensor Type - Barcode (iVu Plus BCR)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
55	Sensor Type ID	16-bit integer
56	Barcode Count	16-bit integer
57	Barcode-1 Type	16-bit integer
58	Barcode-1 Actual Decoded Data Length	16-bit integer
59-60	Barcode-1 Data Array Length	32-bit integer
61-162	Barcode-1 Data Array	100 Byte Array
163-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

4.3.3 PLC Assembly Instance 0x66 (102) (iVu Outputs/PLC Inputs)

Table 6: Sensor Type (iVu Plus BCR)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
1	Output Bits Register (see *Input and Output Flags Bits* on page 25)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30	Barcode Count	16-bit integer
31	Barcode-1 Type	16-bit integer
32	Barcode-1 Length	16-bit integer
33-50	Barcode-1 Data	32-bit length + 32-byte array
51	Barcode-2 Type	16-bit integer
52	Barcode-2 Length	16-bit integer
53-70	Barcode-2 Data	32-bit length + 32-byte array
71	Barcode-3 Type	16-bit integer
72	Barcode-3 Length	16-bit integer
73-90	Barcode-3 Data	32-bit length + 32-byte array
91	Barcode-4 Type	16-bit integer
92	Barcode-4 Length	16-bit integer
93-110	Barcode-4 Data	32-bit length + 32-byte array
111	Barcode-5 Type	16-bit integer
112	Barcode-5 Length	16-bit integer
113-130	Barcode-5 Data	32-bit length + 32-byte array
131	Barcode-6 Type	16-bit integer
132	Barcode-6 Length	16-bit integer
133-150	Barcode-6 Data	32-bit length + 32-byte array
151	Barcode-7 Type	16-bit integer
152	Barcode-7 Length	16-bit integer
153-170	Barcode-7 Data	32-bit length + 32-byte array
171	Barcode-8 Type	16-bit integer
172	Barcode-8 Length	16-bit integer
173-190	Barcode-8 Data	32-bit length + 32-byte array
191	Barcode-9 Type	16-bit integer
192	Barcode-9 Length	16-bit integer
193-210	Barcode-9 Data	32-bit length + 32-byte array
211	Barcode-10 Type	16-bit integer
212	Barcode-10 Length	16-bit integer
213-230	Barcode-10 Data	32-bit length + 32-byte array
231-239	*reserved*	

4.4 Multiple Sensors Mapping Options

When using an iVu Plus TG with multiple sensors in an inspection, there are two mapping options: Default and Custom.

4.4.1 Default Map

Main Menu > System > Communications > Industrial EtherNet > Map > Default

Automatically maps sensor data for each inspection. Recommended when the execution order of sensor types is the same across inspections. When an inspection has multiple sensors, the first 5 sensor results are shown starting at offset 55. Each sensor result occupies 20 words.

The following is a table of EIP assembly 0×65 when using Default Map setting.

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register	16-bit integer
1	Output Bits Register	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	reserved	
30-52	Inspection Name	2-Word Length + 20-Unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID (Sensor 1)	16-bit integer
56-74	Sensor 1 Specific Data	16-bit integer
75	Sensor Type ID (Sensor 2)	16-bit integer
76-94	Sensor 2 Specific Data	16-bit integer
95	Sensor Type ID (Sensor 3)	16-bit integer
96-114	Sensor 3 Specific Data	16-bit integer
115	Sensor Type ID (Sensor 4)	16-bit integer
116-134	Sensor 4 Specific Data	16-bit integer
135	Sensor Type ID (Sensor 5)	16-bit integer
136-154	Sensor 5 Specific Data	16-bit integer
155-170	reserved	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	reserved	

If the inspection contains more than 5 sensors, the sensor(s) after the 5th one will not be on the map.

Table 7: Area Sensor Type ID = 2

Sensor Specific Data	Data Size
Area Count	32- bit integer
Area Range Min	32- bit integer
Area Range Max	32- bit integer

Table 8: Blemish Sensor Type ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32- bit integer
Blemish Min Edge Length	32- bit integer
Blemish Min Edge Length	32- bit integer

Table 9: Match Sensor Type ID = 4

Sensor Specific Data	Sensor Location
Match Count	32- bit integer
Match Min Percent	16- bit integer
Match Max Percent	16- bit integer

Table 10: Sort Sensor Type ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer
Sort Pattern 10 Count	16-bit integer
Sort Min Percent Match	16-bit integer
Sort Max Percent Match	16-bit integer

4.4.2 Custom Map

Main Menu > System > Communications > Industrial EtherNet > Map > Custom

Allows customization of fix sensor data on the map. Select data items of interest for each sensor type. Recommended when execution order of sensor types vary across inspections or when using more than 5 sensors.

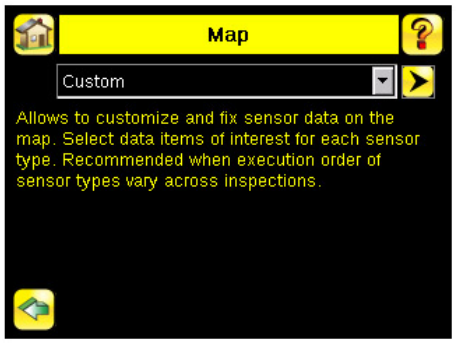
A System level custom map is supported for additional flexibility. When Custom Map is selected, a customizable space is used in the offset range (55 to 166) on EIP assembly 0x65 registers.

The following is a table of EIP assembly 0x65 registers when using Custom Map setting.

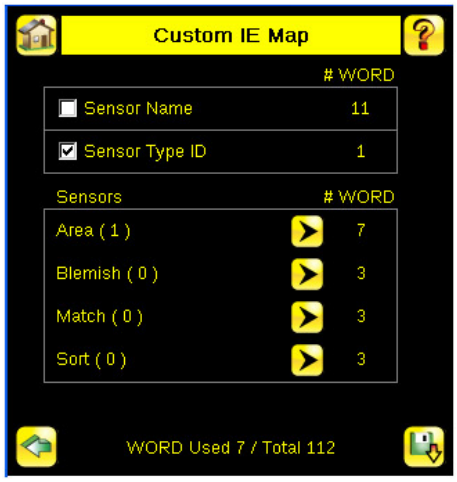
WORD #	WORD NAME	Data Type
0	Input Bits ACK Register	16-bit integer
1	Output Bits Register	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55-166	Customizable Space (112 reg)	
167-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Configure Custom Map

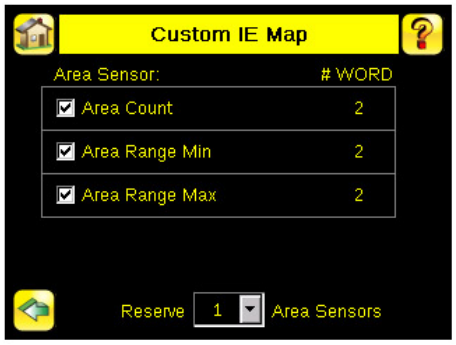
Enable Custom Map by selecting Custom on the drop down list.



Click on the yellow arrow button to Custom IE Map screen. Custom IE Map screen allows choosing sensor result data that will appear on the customizable space.



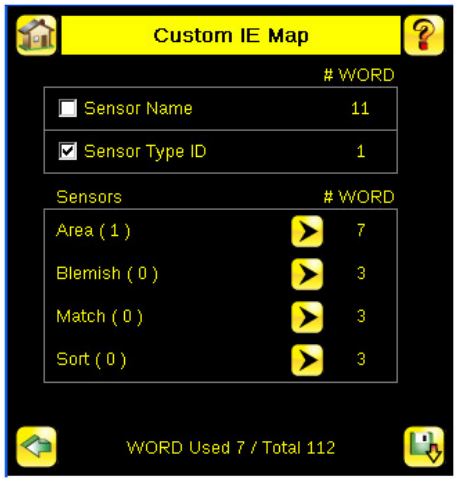
The bottom of the screen shows the word usage on the customizable space. In the screenshot above, seven words have been used for one Area sensor "Area (1)". Use the yellow arrow button next to the Area sensor row to go to the "Area Sensor Data" in the following graphic.



On the "Area Sensor Data" screen above, "Area Count", "Area Range Min" and "Area Range Max" are available to add into the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area Sensors that will be reserved on the customizable space.

Since only one Area Sensor's worth of data is reserved on the screenshot above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area Sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

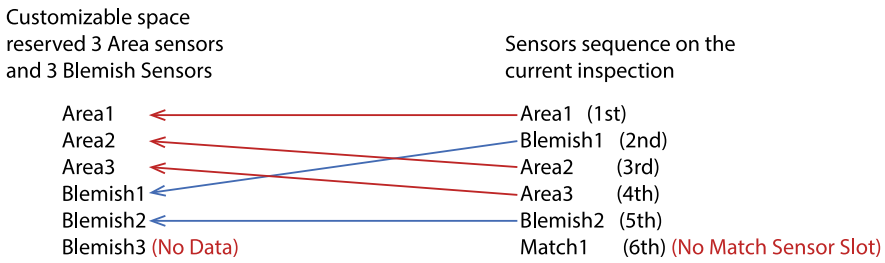
Use the green arrow icon (Back) button to go back to the custom map summary screen.



User may continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

"Sensor Name" and "Sensor Type ID" are global settings that are part of any individual sensor reservation. When they are checked, they will be inserted into each sensor reservation.

Here is an example of multiple sensors inspection and its output location on the customizable space.



There are only 2 Blemish sensors on the current inspection; Blemish3 location will be all zero on the customizable space. The customizable space had not reserved a Match sensor, Match1 from the inspection will not be outputted on the customizable space.

4.5 Input and Output Flags Bits

Inputs Bits Register (Command Flag Bits)

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command									Set BCR Mask	Set BCR String		Gated Trigger	Trigger	Teach Latch	Product Change

Input Bits ACK Register (ACK Flag Bits)

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command ACK									Set BCR Mask ACK	Set BCR String ACK		Gated Trigger ACK	Trigger ACK	Teach Latch ACK	Product Change ACK

Output Bits Register (iVu Status Flag Bits)

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Execution Error	System Error	Teach Error	Missed Trigger					Output 3	Output 2	Output 1		Ready Latch	Read/ No Read	Pass/Fail	Ready

4.6 Configuration Assembly Object

The iVuPlus EIP implementation does not support an assembly object configuration instance. However, one is required for creation of implicit Class 1 connections on a ControlLogix family PLC. Therefore, a configuration instance is defined as instance number 0x80 (128 decimal). Its size is zero.

4.7 Data Formats

The iVuPlus EIP implementation supports 32-bit Integers in LSW_MSW data format. The least significant word is stored first, then the most significant word. This format is used for Allen-Bradley ControlLogix PLCs.

The string format is compatible with the Allen-Bradley ControlLogix built-in string data type. This format is a 32 bit (DINT) length followed by character bytes (SINT). This results in the following string format as viewed from the iVu Plus:

Word	0	1	2		3		4			
	Length LSW	Length MSW	byte 1	byte 0	byte 3	byte 2	byte 5	byte 4	...	...

4.8 Minimum Requested Packet Inverval (RPI) Value

iVuPlus devices can operate with input and output Requested Packet Intervals (RPIs) as low as 50 milliseconds. The device may not operate reliably if a lower RPI value is selected.

5 Modbus/TCP

The Modbus/TCP protocol provides device control using register and coil banks defined by the slave device. This section defines the iVu Plus Modbus/TCP register and coil banks. From the point of view of the slave device (PLC), there is one output coil registers and two Input Coil registers. The bits in the Output Coil Registers cause actions to occur. The corresponding ACK bits in the Input Coil register get set when the action is complete. The Status Coil register provides status of certain system states. By specification, Modbus/TCP uses TCP port 502.

Note that the output coils correspond to the Output and ACK Flags, and the input coils correspond to the Input Flags.

Modbus Function Codes Supported:

01: Read Coil Status

02: Read Input Status

03: Read Holding Registers

04: Read Input Registers

05: Force Single Coil

06: Preset Single Register

07: Read Exception Status

15: Write Multiple Coils

16: Preset Multiple Registers

5.1 Holding Registers

The Holding registers are used by the PLC to push values to the iVu Plus sensor. These values are accessed in the register address range of 40001 - 40240. To write, use Function Codes 6/16 (Preset Single/Multiple Registers). Also available in this range of registers are the registers containing output data. These outputs are available using the address range of 41001 - 41480. To read these output into the PLC use Function Code 03 (Read Holding Registers).

Table 11: Modbus/TCP iVu Input Registers Map

REGISTER	WORD NAME	DATA TYPE
40001	Input Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
40002-3	Product Change Number	32-bit integer
40004-50	*reserved*	32-bit integer
40051	Command ID	16-bit integer
40052	Command Parameter Int16	16-bit integer
40053-54	Command Parameter Int 32	32-bit integer
40055-56	Command Parameter	Float
40057-58	Command Parameter String Length	32-bit integer
40059-108	Command Parameter String	100 Byte Array
40109	*reserved*	16-bit integer
40110-111	BCR String/Mask Length	32-bit integer
40112-211	BCR String/Mask	200 Byte Array
40212-240	*reserved*	

5.2 Output Registers

The Output registers are used to send output values from the iVu Plus to the PLC. Note that some devices (such as Modicon family PLCs) cannot access data using the 30000 range of register addresses. For these devices, the output values are also available using the 40000 range of addresses (at offset 41000). To access the Modbus/TCP Output Registers use Function Code 04 (Read Input Registers).

Output Registers Map

Table 12: Sensor Type - Area (iVu Plus TG)

REGISTER	WORD NAME	DATA TYPE
30001	Input Coil ACK Bits (see *Input and Output Coils* on page 38)	16-bit integer
30002	Status Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056	Sensor Type ID	16-bit integer
30057-58	Area Count	32-bit integer
30059-60	Area Range Min	32-bit integer
30061-62	Area Range Max	32-bit integer
30063-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-75	Command Response Int32	32-bit integer
30176-77	Command Response	Float
30178-79	Command Response Length	16-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	

Table 13: Sensor Type - Blemish (iVu Plus TG)

REGISTER	WORD NAME	DATA TYPE
30001	Input Coil ACK Bits (see *Input and Output Coils* on page 38)	16-bit integer
30002	Status Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056	Sensor Type ID	16-bit integer
30057-58	Blemish Count	32-bit integer
30059-60	Blemish Min Edge Length	32-bit integer
30061-62	Blemish Max Edge Length	32-bit integer
30063-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-75	Command Response Int32	32-bit integer
30176-77	Command Response	Float
30178-79	Command Response Length	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	

Table 14: Sensor Type - Match (iVu Plus TG)

REGISTER	WORD NAME	DATA TYPE
30001	Input Coil ACK Bits (see *Input and Output Coils* on page 38)	16-bit integer
30002	Status Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056	Sensor Type ID	16-bit integer
30057-58	Match Count	32-bit integer
30059	Match Min Percent Match	16-bit integer
30060	Match Max Percent Match	16-bit integer
30061-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-75	Command Response Int32	32-bit integer
30176-77	Command Response	Float
30178-79	Command Response Length	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	

Table 15: Sensor Type - Sort (iVu Plus TG)

REGISTER	WORD NAME	DATA TYPE
30001	Input Coil ACK Bits (see *Input and Output Coils* on page 38)	16-bit integer
30002	Status Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056	Sensor Type ID	16-bit integer
30057	Sort Pattern Map	16-bit integer
30058	Sort Pattern Count	16-bit integer
30059	Sort Pattern 1 Count	16-bit integer
30060	Sort Pattern 2 Count	16-bit integer
30061	Sort Pattern 3 Count	16-bit integer
30062	Sort Pattern 4 Count	16-bit integer
30063	Sort Pattern 5 Count	16-bit integer
30064	Sort Pattern 6 Count	16-bit integer
30065	Sort Pattern 7 Count	16-bit integer
30066	Sort Pattern 8 Count	16-bit integer
30067	Sort Pattern 9 Count	16-bit integer
30068	Sort Pattern 10 Count	16-bit integer
30069	Sort Min Percent Match	16-bit integer
30070	Sort Max Percent Match	16-bit integer
30071-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-75	Command Response Int32	32-bit integer
30176-77	Command Response	Float
30178-79	Command Response Length	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	

Table 16: Sensor Type - Barcode-1 (iVu Plus BCR)

REGISTER	WORD NAME	DATA TYPE
30001	Input Coil ACK Bits (see *Input and Output Coils* on page 38)	16-bit integer
30002	Status Coil Bits (see *Input and Output Coils* on page 38)	16-bit integer
3003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056	Sensor Type ID	16-bit integer
30057	Barcode Count	16-bit integer
30058	Barcode-1 Type	16-bit integer
30059	Barcode-1 Actual Decoded Data Length	16-bit integer
30060-61	Barcode-1 Data Array Len.	32-bit integer
30062-163	Barcode-1 Data Array	100 Byte Array
30164-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-75	Command Response Int32	32-bit integer
30176-77	Command Response	Float
30178-79	Command Response Len.	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	
30241	Barcode Count	16-bit integer
30242	Barcode-1 Type	16-bit integer
30243	Barcode-1 Length	16-bit integer
30244-61	Barcode-1 Data	32-bit length + 32-byte array
30262	Barcode-2 Type	16-bit integer
30263	Barcode-2 Length	16-bit integer
30264-81	Barcode-2 Data	32-bit length + 32-byte array
30282	Barcode-3 Type	16-bit integer
30283	Barcode-3 Length	16-bit integer
30284-301	Barcode-3 Data	32-bit length + 32-byte array
30302	Barcode-4 Type	16-bit integer
30303	Barcode-4 Length	16-bit integer
30304-21	Barcode-4 Data	32-bit length + 32-byte array

REGISTER	WORD NAME	DATA TYPE
30322	Barcode-5 Type	16-bit integer
30323	Barcode-5 Length	16-bit integer
30324-41	Barcode-5 Data	32-bit length + 32-byte array
30342	Barcode-6 Type	16-bit integer
30343	Barcode-6 Length	16-bit integer
30344-61	Barcode-6 Data	32-bit length + 32-byte array
30362	Barcode-7 Type	16-bit integer
30363	Barcode-7 Length	16-bit integer
30364-81	Barcode-7 Data	32-bit length + 32-byte array
30382	Barcode-8 Type	16-bit integer
30383	Barcode-8 Length	16-bit integer
30384-401	Barcode-8 Data	32-bit length + 32-byte array
30402	Barcode-9 Type	16-bit integer
30403	Barcode-9 Length	16-bit integer
30404-21	Barcode-9 Data	32-bit len + 32-byte array
304022	Barcode-10 Type	16-bit integer
30423	Barcode-10 Length	16-bit integer
30424-41	Barcode-10 Data	32-bit len + 32-byte array

5.3 Multiple Sensors Mapping Options

When using an iVu Plus TG with multiple sensors in an inspection, there are two mapping options: Default and Custom.

5.3.1 Default Map

Main Menu > System > Communications > Industrial EtherNet > Map > Default

Automatically maps sensor data for each inspection. Recommended when execution order of sensor types is the same across inspections. When inspection has multiple sensors, the first 5 sensor results will be shown starting at offset 55. Each sensor result will occupy 20 words.

The following is a table of MODBUS/TCP registers at 30001 - 30240 when using Default Map setting.

WORD #	WORD NAME	Data Type
30001	Input Coil ACK Bits	16-bit integer
30002	Status Coil Bits	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	16-bit integer
30018-30	reserved	
30031-53	Inspection Name	2-Word Length + 20-Unicode chars
30054-55	Frame Number	32-bit integer

WORD #	WORD NAME	Data Type
30056	Sensor Type ID (Sensor 1)	16-bit integer
30057-30075	Sensor 1 Specific Data	16-bit integer
30076	Sensor Type ID (Sensor 2)	16-bit integer
30077-90	Sensor 2 Specific Data	16-bit integer
30096	Sensor Type ID (Sensor 3)	16-bit integer
30097-30115	Sensor 3 Specific Data	16-bit integer
30116	Sensor Type ID (Sensor 4)	16-bit integer
30117-135	Sensor 4 Specific Data	16-bit integer
30136	Sensor Type ID (Sensor 5)	16-bit integer
30137-155	Sensor 5 Specific Data	16-bit integer
30156-171	reserved	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-175	Command Response Int32	32-bit integer
30176-177	Command Response Float	Float
30178-179	Command Response Length	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	reserved	

If the inspection contains more than 5 sensors, the sensor(s) after the 5th one will not be on the map.

Table 17: Area Sensor Type ID = 2

Sensor Specific Data	Data Size
Area Count	32- bit integer
Area Range Min	32- bit integer
Area Range Max	32- bit integer

Table 18: Blemish Sensor Type ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32- bit integer
Blemish Min Edge Length	32- bit integer
Blemish Min Edge Length	32- bit integer

Table 19: Match Sensor Type ID = 4

Sensor Specific Data	Sensor Location
Match Count	32- bit integer
Match Min Percent	16- bit integer
Match Max Percent	16- bit integer

Table 20: Sort Sensor Type ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer
Sort Pattern 10 Count	16-bit integer
Sort Min Percent Match	16-bit integer
Sort Max Percent Match	16-bit integer

5.3.2 Custom Map

Main Menu > System > Communications > Industrial EtherNet > Map > Custom

Allows customization of fix sensor data on the map. Select data items of interest for each sensor type. Recommended when execution order of sensor types vary across inspections or when using more than 5 sensors.

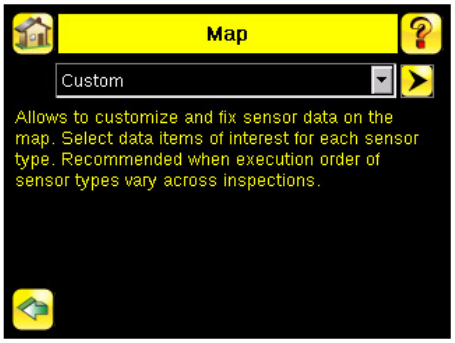
A System level custom map is supported for additional flexibility. When Custom Map is selected, a customizable space is used in the offset range (30056 to 30167) MODBUS/TCP registers.

The following is a table of MODBUS/TCP registers 30001 to 30240 when using Custom Map setting.

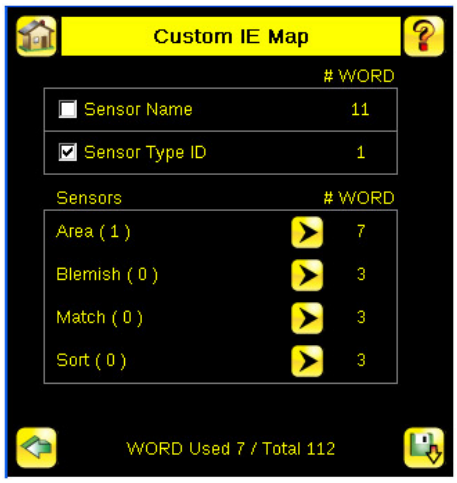
WORD #	WORD NAME	Data Type
30001	Inputs Bits ACK Register	16-bit integer
30002	Output Bits Register	16-bit integer
30003-4	Error Code	32-bit integer
30005-6	Inspection Number	32-bit integer
30007-8	Iteration Count	32-bit integer
30009-10	Pass Count	32-bit integer
30011-12	Fail Count	32-bit integer
30013-14	Missed Triggers	32-bit integer
30015-16	Current Inspection Time	Float
30017	Sensor Pass/Fail Coil	16-bit integer
30018-30	*reserved*	
30031-53	Inspection Name	2-Word Length + 20-unicode chars
30054-55	Frame Number	32-bit integer
30056-67	Customizable Space (112 reg)	
30168-171	*reserved*	
30172	Command Status	16-bit integer
30173	Command Response Int16	16-bit integer
30174-175	Command Response Int32	32-bit integer
30176-177	Command Response Float	Float
30178-179	Command Response Length	32-bit integer
30180-229	Command Response Data	100 Byte Array
30230-240	*reserved*	

Configure Custom Map

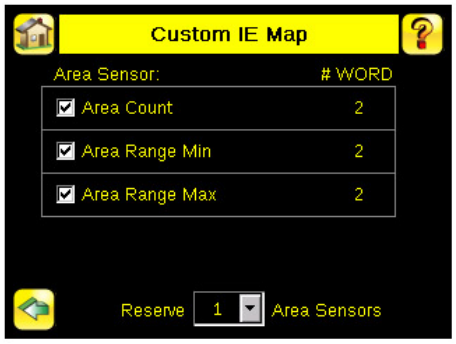
Enable Custom Map by selecting Custom on the drop down list.



Click on the yellow arrow button to Custom IE Map screen. Custom IE Map screen allows choosing sensor result data that will appear on the customizable space.



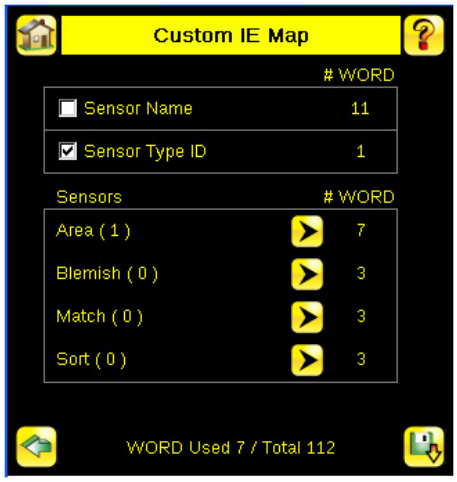
The bottom of the screen shows the word usage on the customizable space. In the screenshot above, seven words have been used for one Area sensor "Area (1)". Use the yellow arrow button next to the Area sensor row to go to the "Area Sensor Data" in the following graphic.



On the "Area Sensor Data" screen above, "Area Count", "Area Range Min" and "Area Range Max" are available to add into the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area Sensors that will be reserved on the customizable space.

Since only one Area Sensor's worth of data is reserved on the screenshot above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area Sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

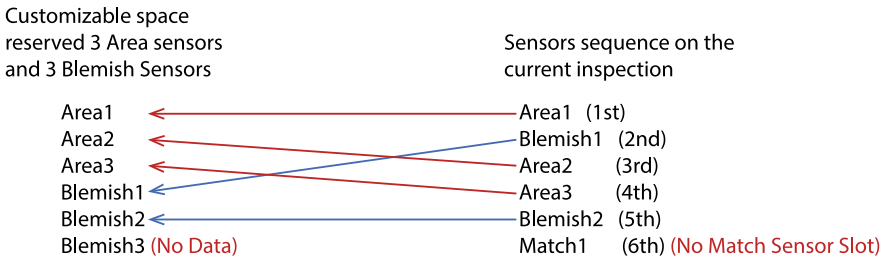
Use the green arrow icon (Back) button to go back to the custom map summary screen.



User may continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

"Sensor Name" and "Sensor Type ID" are global settings that are part of any individual sensor reservation. When they are checked, they will be inserted into each sensor reservation.

Here is an example of multiple sensors inspection and its output location on the customizable space.



There are only 2 Blemish sensors on the current inspection; Blemish3 location will be all zero on the customizable space. The customizable space had not reserved a Match sensor, Match1 from the inspection will not be outputted on the customizable space.

5.4 Input and Output Coils

The Modbus/TCP Input Coil Bits are used to push single bit commands from the PLC/HMI to the iVu Plus sensor. To access the Modbus/TCP Coil ACK Bits (reg. 30001) and Status Coil Bits (reg. 30002) use Function Code 02 (Read Input Status).

Input Coil Bits

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command									Set BCR Mask	Set BCR String		Gated Trigger	Trigger	Teach Latch	Product Change

Input Coil ACK Bits

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command ACK									Set BCR Mask ACK	Set BCR String ACK		Gated Trigger ACK	Trigger ACK	Teach Latch ACK	Product Change ACK

Status Coil Bits

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Execution Error	System Error	Teach Error	Missed Trigger					Output 3	Output 2	Output 1		Ready Latch	Read/ No Read	Pass/Fail	Ready

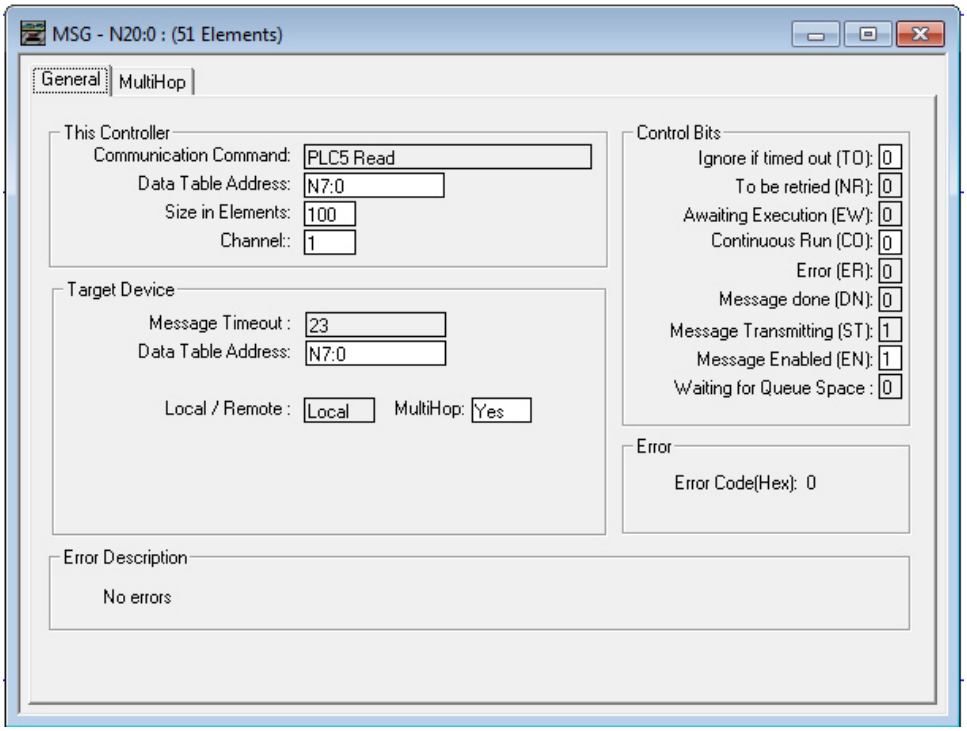
6 PLC5 and SLC 5 (PCCC)

Allen-Bradley's PLC5 and SLC 500 family of devices use PCCC communications protocol. iVu Plus supports these PLCs using input and output register arrays. The Output Flags, ACK Flags and Input Flags bit definitions are the same as defined in the EIP Assembly Objects section. The terms "Input" and "Output" are from the point of view of the PLC.

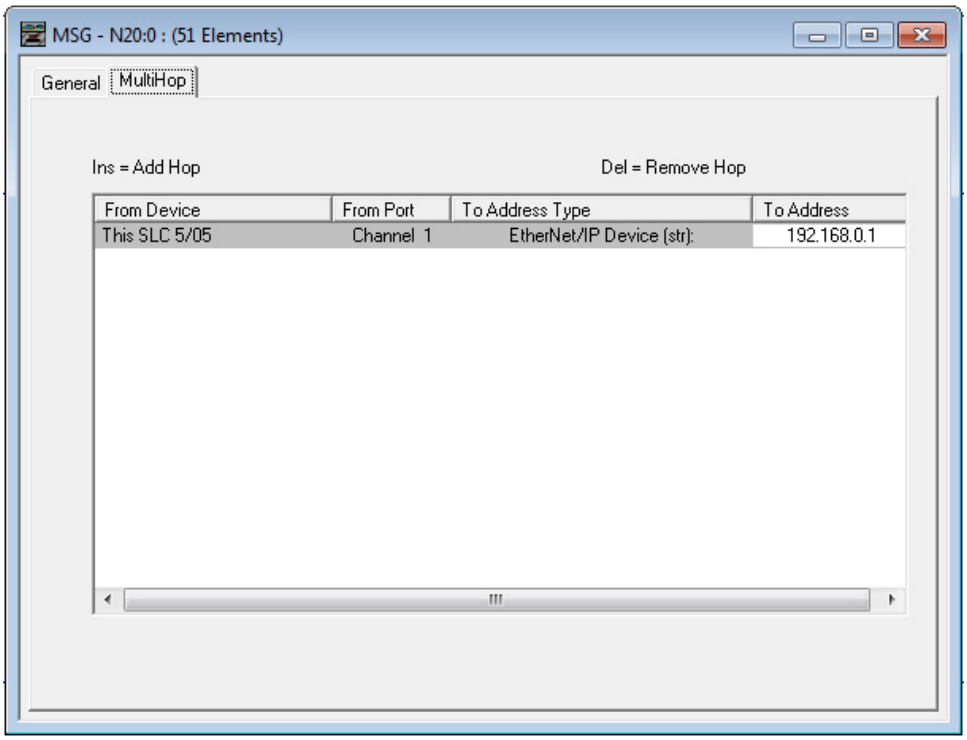
6.1 Configuration

The images below represent a typical configuration:

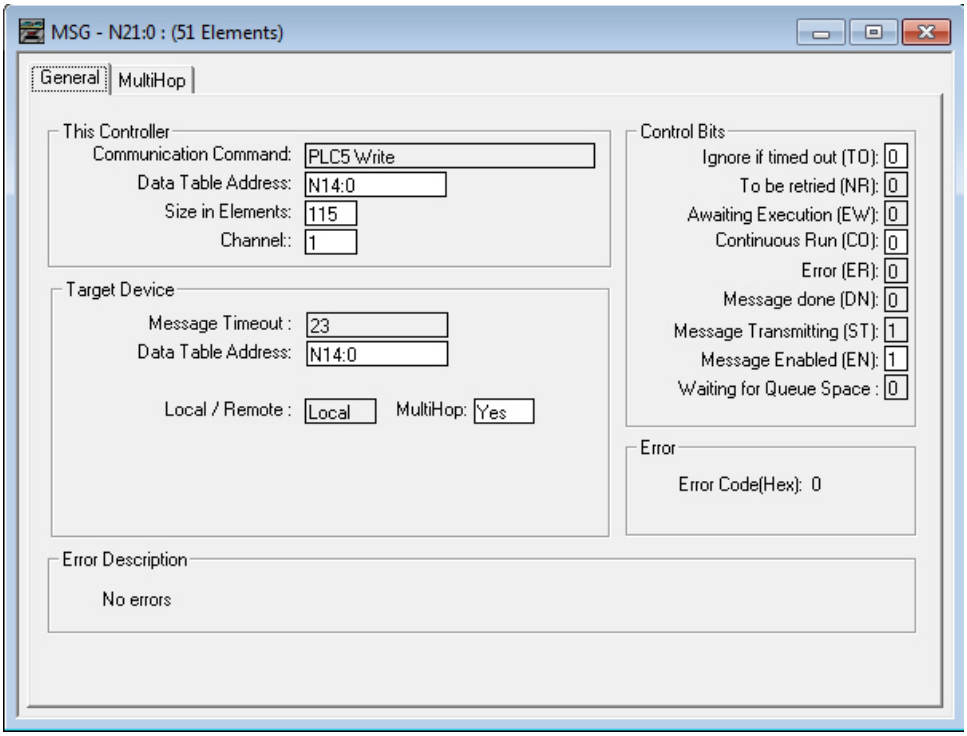
1. Read. Message command_reading from N7 tabe on iVu Plus



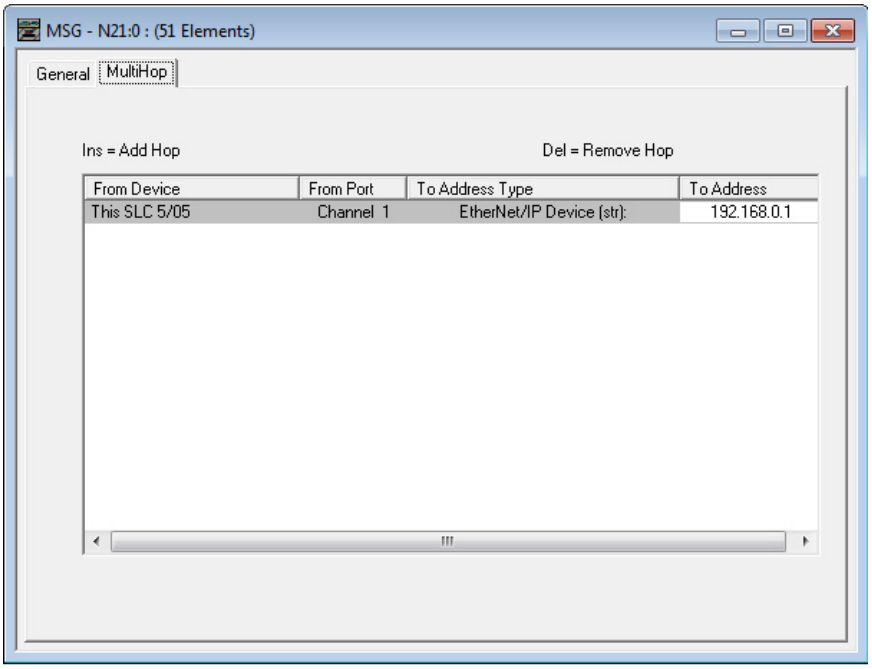
2. Read. IP Address of the iVu Plus is entered here.



3. Write. Message command_writing to N14 table on iVu Plus



4. Write. IP Address of the iVu Plus is entered here.



6.2 Inputs to iVu (Outputs from PLC)

The Input registers are used by the PLC to push values to the iVu Plus sensor. MSG (message) commands are used to Read (N7) and Write (N14) to the sensor.

Table 21: PLC Output Registers Map (N14) (iVu Inputs)

WORD #	WORD NAME	DATA TYPE
0	Input Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
1-2	Product Change Number	32-bit integer
3-49	*reserved*	32-bit integer
50	Command ID	16-bit integer
51	Command Parameter Int16	16-bit integer
52-53	Command Parameter Int 32	32-bit integer
54-55	Command Parameter	Float
56-57	Command Parameter String Length	32-bit integer
58-107	Command Parameter String	100 Byte Array
108	*reserved*	16-bit integer
109-110	BCR String/Mask Length	32-bit integer
111-120	BCR String/Mask	200 Byte Array
211-239	*reserved*	

6.3 Outputs from iVu (Inputs to PLC)

The Output registers are used to push output values from the iVu Plus to the PLC. MSG (message) commands are used to Read (N7) and Write (N14) to the sensor.

PLC Input Registers Map (N7) (iVu Outputs)

Table 22: Sensor Type - Area (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags* on page 52)	16-bit integer
1	Output Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Area Count	32-bit integer
58-59	Area Range Min	32-bit integer
60-61	Area Range Max	32-bit integer
62-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 23: Sensor Type - Blemish (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags* on page 52)	16-bit integer
1	Output Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Blemish Count	32-bit integer
58-59	Blemish Min Edge Length	32-bit integer
60-61	Blemish Max Edge Length	32-bit integer
62-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 24: Sensor Type - Match (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags* on page 52)	16-bit integer
1	Output Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56-57	Match Count	32-bit integer
58	Match Min Percent Match	16-bit integer
59	Match Max Percent Match	16-bit integer
60-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 25: Sensor Type - Sort (iVu Plus TG)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags* on page 52)	16-bit integer
1	Output Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56	Sort Pattern Map	16-bit integer
57	Sort Pattern Count	16-bit integer
58	Sort Pattern 1 Count	16-bit integer
59	Sort Pattern 2 Count	16-bit integer
60	Sort Pattern 3 Count	16-bit integer
61	Sort Pattern 4 Count	16-bit integer
62	Sort Pattern 5 Count	16-bit integer
63	Sort Pattern 6 Count	16-bit integer
64	Sort Pattern 7 Count	16-bit integer
65	Sort Pattern 8 Count	16-bit integer
66	Sort Pattern 9 Count	16-bit integer
67	Sort Pattern 10 Count	16-bit integer
68	Sort Min Percent Match	16-bit integer
69	Sort Max Percent Match	16-bit integer
70-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Table 26: Sensor Type - Barcode-1 (iVu Plus BCR)

WORD #	WORD NAME	DATA TYPE
0	Input Bits ACK Register (see *Input and Output Flags* on page 52)	16-bit integer
1	Output Bits Register (see *Input and Output Flags* on page 52)	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID	16-bit integer
56	Barcode Count	16-bit integer
57	Barcode-1 Type	16-bit integer
58	Barcode-1 Actual Decoded Data Length	16-bit integer
59-60	Barcode-1 Data Array Length	32-bit integer
61-162	Barcode-1 Data Array	100 Byte Array
163-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Comand Response	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	
240	Barcode Count	16-bit integer
241	Barcode-1 Type	16-bit integer
242	Barcode-1 Length	16-bit integer
243-260	Barcode-1 Data	32-bit length + 32-byte array
261	Barcode-2 Type	16-bit integer
262	Barcode-2 Length	16-bit integer
263-280	Barcode-2 Data	32-bit length + 32-byte array
281	Barcode-3 Type	16-bit integer
282	Barcode-3 Length	16-bit integer
283-300	Barcode-3 Data	32-bit length + 32-byte array
301	Barcode-4 Type	16-bit integer
302	Barcode-4 Length	16-bit integer
303-320	Barcode-4 Data	32-bit length + 32-byte array

WORD #	WORD NAME	DATA TYPE
321	Barcode-5 Type	16-bit integer
322	Barcode-5 Length	16-bit integer
323-340	Barcode-5 Data	32-bit length + 32-byte array
341	Barcode-6 Type	16-bit integer
342	Barcode-6 Length	16-bit integer
343-360	Barcode-6 Data	32-bit length + 32-byte array
361	Barcode-7 Type	16-bit integer
362	Barcode-7 Length	16-bit integer
363-380	Barcode-7 Data	32-bit length + 32-byte array
381	Barcode-8 Type	16-bit integer
382	Barcode-8 Length	16-bit integer
383-400	Barcode-8 Data	32-bit length + 32-byte array
401	Barcode-9 Type	16-bit integer
402	Barcode-9 Length	16-bit integer
403-420	Barcode-9 Data	32-bit length + 32-byte array
421	Barcode-10 Type	16-bit integer
422	Barcode-10 Length	16-bit integer
423-440	Barcode-10 Data	32-bit length + 32-byte array

6.4 Multiple Sensors Mapping Options

When using an iVu Plus TG with multiple sensors in an inspection, there are two mapping options: Default and Custom.

6.4.1 Default Map

Main Menu > System > Communications > Industrial EtherNet > Map > Default

Automatically maps sensor data for each inspection. Recommended when execution order of sensor types is the same across inspections. When inspection has multiple sensors, the first 5 sensor results will be shown starting at offset 55. Each sensor result will occupy 20 words.

The following is a table of PCCC PLC Input Registers Map (N7) when using Default Map setting.

WORD #	WORD NAME	Data Type
0	Input Bits ACK Register	16-bit integer
1	Output Bits Register	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	reserved	
30-52	Inspection Name	2-Word Length + 20-Unicode chars
53-54	Frame Number	32-bit integer
55	Sensor Type ID (Sensor 1)	16-bit integer
56-74	Sensor 1 Specific Data	16-bit integer
75	Sensor Type ID (Sensor 2)	16-bit integer
76-89	Sensor 2 Specific Data	16-bit integer
95	Sensor Type ID (Sensor 3)	16-bit integer
95-114	Sensor 3 Specific Data	16-bit integer
115	Sensor Type ID (Sensor 4)	16-bit integer
116-134	Sensor 4 Specific Data	16-bit integer
135	Sensor Type ID (Sensor 5)	16-bit integer
136-154	Sensor 5 Specific Data	16-bit integer
155-170	reserved	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	reserved	

If the inspection contains more than 5 sensors, the sensor(s) after the 5th one will not be on the map.

Table 27: Area Sensor Type ID = 2

Sensor Specific Data	Data Size
Area Count	32- bit integer
Area Range Min	32- bit integer
Area Range Max	32- bit integer

Table 28: Blemish Sensor Type ID = 3

Sensor Specific Data	Sensor Location
Blemish Count	32- bit integer
Blemish Min Edge Length	32- bit integer
Blemish Min Edge Length	32- bit integer

Table 29: Match Sensor Type ID = 4

Sensor Specific Data	Sensor Location
Match Count	32- bit integer
Match Min Percent	16- bit integer
Match Max Percent	16- bit integer

Table 30: Sort Sensor Type ID = 5

Sensor Specific Data	Sensor Location
Sort Pattern Map	16-bit integer
Sort Pattern Count	16-bit integer
Sort Pattern 1 Count	16-bit integer
Sort Pattern 2 Count	16-bit integer
Sort Pattern 3 Count	16-bit integer
Sort Pattern 4 Count	16-bit integer
Sort Pattern 5 Count	16-bit integer
Sort Pattern 6 Count	16-bit integer
Sort Pattern 7 Count	16-bit integer
Sort Pattern 8 Count	16-bit integer
Sort Pattern 9 Count	16-bit integer
Sort Pattern 10 Count	16-bit integer
Sort Min Percent Match	16-bit integer
Sort Max Percent Match	16-bit integer

6.4.2 Custom Map

Main Menu > System > Communications > Industrial EtherNet > Map > Custom

Allows customization of fix sensor data on the map. Select data items of interest for each sensor type. Recommended when execution order of sensor types vary across inspections or when using more than 5 sensors.

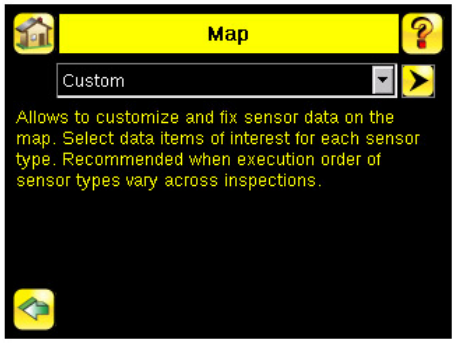
A System level custom map is supported for additional flexibility. When Custom Map is selected, a customizable space is used in the offset range (55 to 166) on PCCC registers.

The following is a table of PCCC PLC Input Registers Map (N7) when using Custom Map setting.

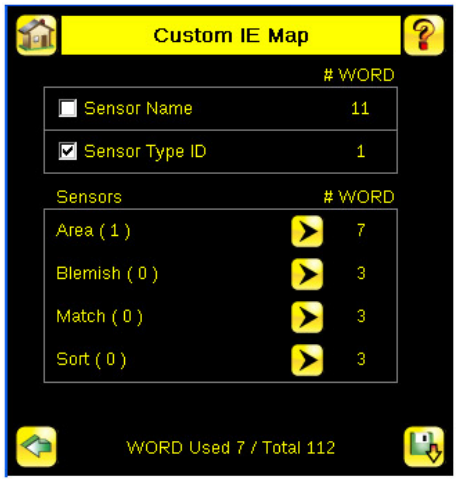
WORD #	WORD NAME	Data Type
0	Input Bits ACK Register	16-bit integer
1	Output Bits Register	16-bit integer
2-3	Error Code	32-bit integer
4-5	Inspection Number	32-bit integer
6-7	Iteration Count	32-bit integer
8-9	Pass Count	32-bit integer
10-11	Fail Count	32-bit integer
12-13	Missed Triggers	32-bit integer
14-15	Current Inspection Time	Float
16	Sensor Pass/Fail Coil	16-bit integer
17-29	*reserved*	
30-52	Inspection Name	2-Word Length + 20-unicode chars
53-54	Frame Number	32-bit integer
55-166	Customizable Space (112 reg)	
167-170	*reserved*	
171	Command Status	16-bit integer
172	Command Response Int16	16-bit integer
173-174	Command Response Int32	32-bit integer
175-176	Command Response Float	Float
177-178	Command Response Length	32-bit integer
179-228	Command Response Data	100 Byte Array
229-239	*reserved*	

Configure Custom Map

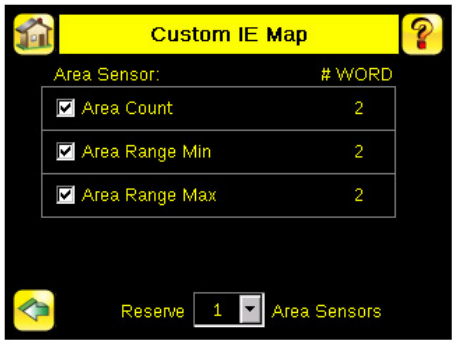
Enable Custom Map by selecting Custom on the drop down list.



Click on the yellow arrow button to Custom IE Map screen. Custom IE Map screen allows choosing sensor result data that will appear on the customizable space.



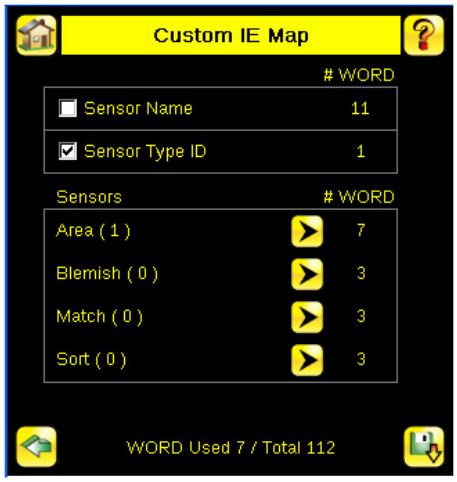
The bottom of the screen shows the word usage on the customizable space. In the screenshot above, seven words have been used for one Area sensor "Area (1)". Use the yellow arrow button next to the Area sensor row to go to the "Area Sensor Data" in the following graphic.



On the "Area Sensor Data" screen above, "Area Count", "Area Range Min" and "Area Range Max" are available to add into the customizable space. The number to the right of each item shows how many words are required to display the data. The bottom reservation count shows the number of Area Sensors that will be reserved on the customizable space.

Since only one Area Sensor's worth of data is reserved on the screenshot above, the selected data will be collected from the first Area sensor in the current inspection. When multiple Area Sensors have been reserved, the data will be arranged in the sequential manner of the sensor type in the current inspection.

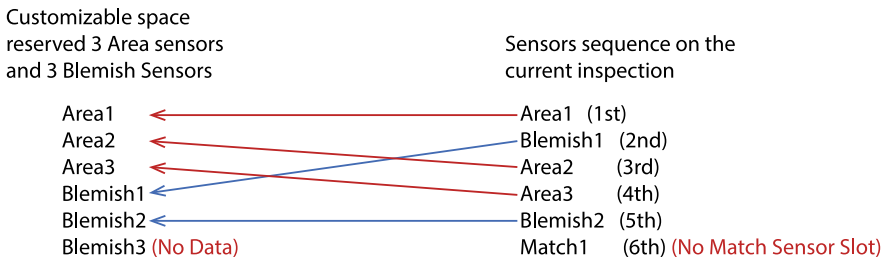
Use the green arrow icon (Back) button to go back to the custom map summary screen.



User may continue to add more data from any sensor type as required or reserve more sensors into the customizable space.

"Sensor Name" and "Sensor Type ID" are global settings that are part of any individual sensor reservation. When they are checked, they will be inserted into each sensor reservation.

Here is an example of multiple sensors inspection and its output location on the customizable space.



There are only 2 Blemish sensors on the current inspection; Blemish3 location will be all zero on the customizable space. The customizable space had not reserved a Match sensor, Match1 from the inspection will not be outputted on the customizable space.

6.5 Input and Output Flags

The Input Bits are used to command execution of basic functions. The Output Bits are used to push single bit outputs from the iVu Sensor to the PLC. The 32 bits of iVu output can also be accessed using the bits of the first two Output Registers (Input Bits ACK Register(word 0) and Output Bits Register (word1)).

Input Bits Register

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command									Set BCR Mask	Set BCR String		Gated Trigger	Trigger	Teach Latch	Product Change

Input Bits ACK Register

Bit Position

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Command ACK									Set BCR Mask ACK	Set BCR String ACK		Gated Trigger ACK	Trigger ACK	Teach Latch ACK	Product Change ACK

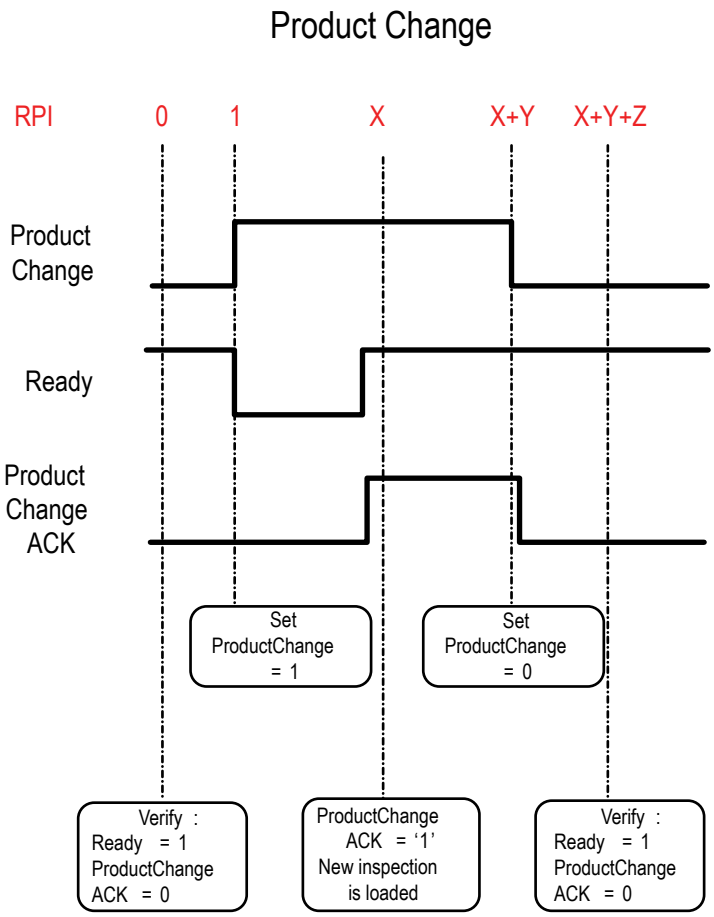
Output Bits Register

Bit Position

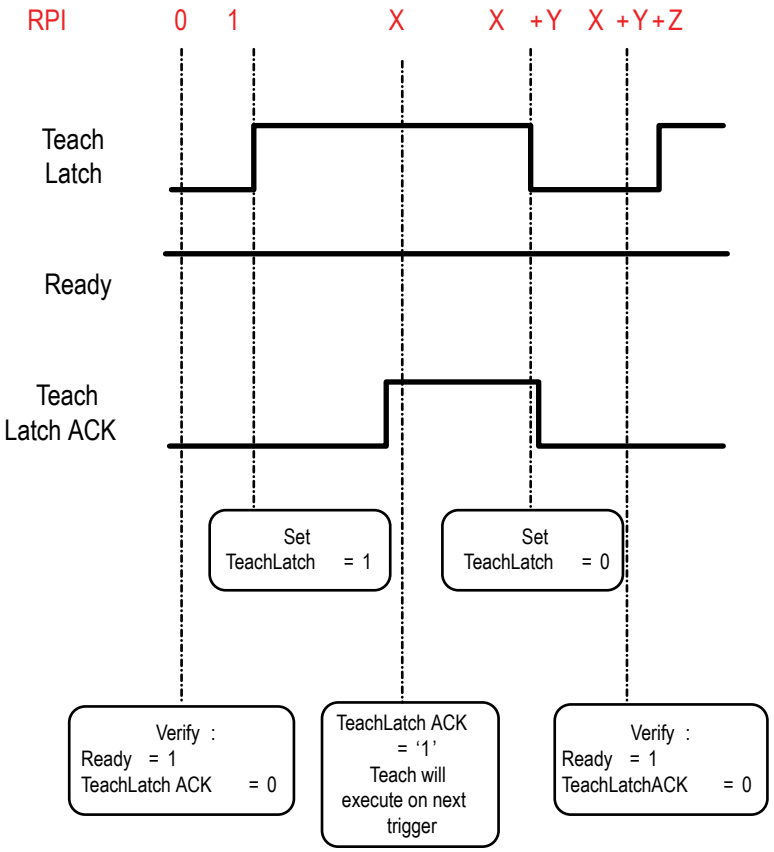
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Execution Error	System Error	Teach Error	Missed Trigger					Output 3	Output 2	Output 1		Ready Latch	Read/ No Read	Pass/Fail	Ready

7 Sample Timing Diagram

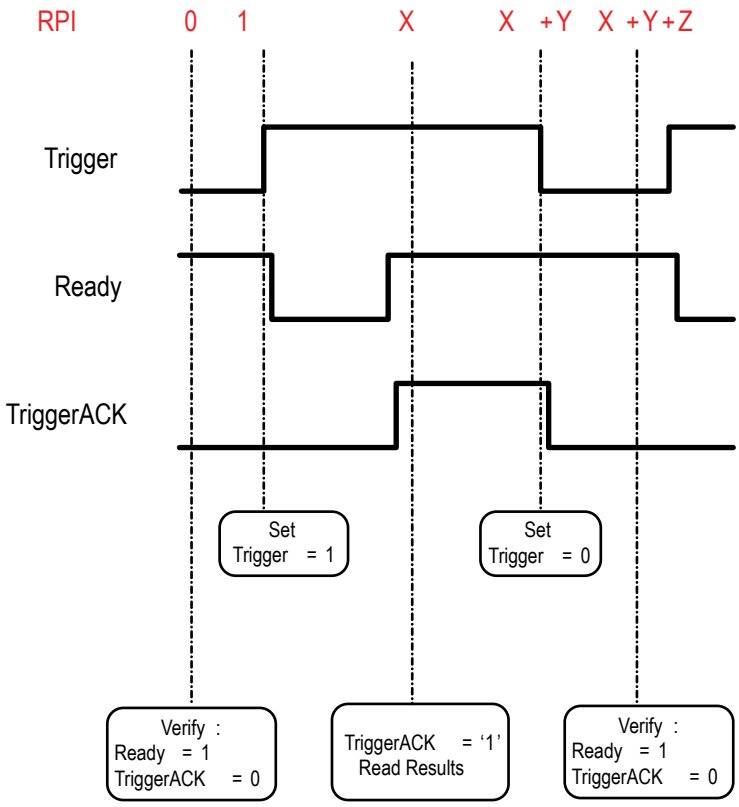
X, Y, Z: Represent snapshot in time



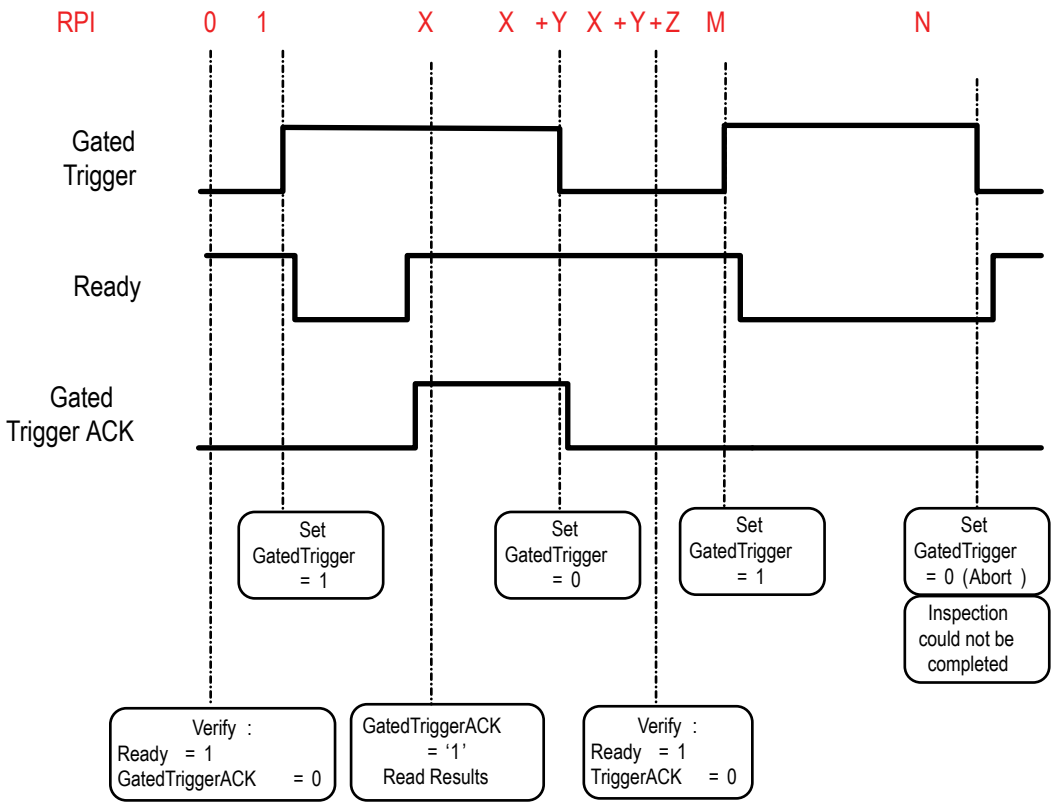
Teach Latch


RPI
0
1
X
X
+Y
X
+Y+Z
Teach Latch
Ready
Teach Latch ACK
Set TeachLatch = 1
Set TeachLatch = 0
Verify :
Ready = 1
TeachLatch ACK = 0
TeachLatch ACK = '1'
Teach will execute on next trigger
Verify :
Ready = 1
TeachLatchACK = 0

Trigger


RPI
0
1
X
X
+Y
X
+Y+Z
Trigger
Ready
TriggerACK
Set
Trigger = 1
Set
Trigger = 0
Verify :
Ready = 1
TriggerACK = 0
TriggerACK = '1'
Read Results
Verify :
Ready = 1
TriggerACK = 0

Gated Trigger



8 Command Channel Command Status Register

The command status is a verification of the command type.

Command Status	Value (16-bit integer)
Unknown	0
Read	1
Write	2
Execute	3

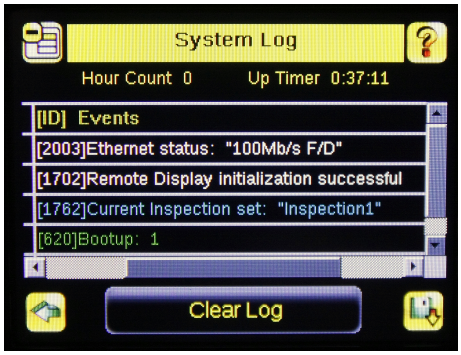
9 Diagnostic Guide

iVu Plus sensors provide several methods to help diagnose communication issues when using Ethernet communications.

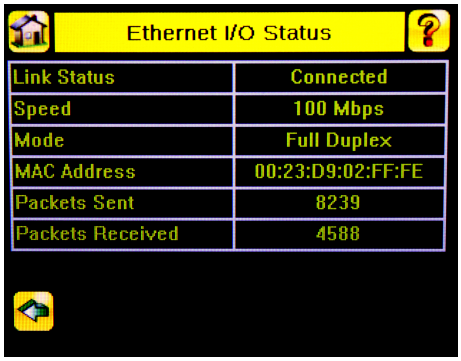
9.1 Ethernet Diagnostics

To verify Ethernet connectivity, follow these steps:

1. Verify that all the cables are connected and properly seated.
2. Examine the small orange Ethernet link light located on the top of camera body, between the Pass/Fail and System Status LEDs. The light should be either on or blinking.
3. Go to the System > Logs > System Log page, and verify that the log entry indicates that the Ethernet link is up:



4. Go to the System > Communications > Ethernet I/O page, and press on the Status button. Verify that the Ethernet Link Status is "Connected", and that the link parameters, such as baud rate and duplex are as expected. For example:

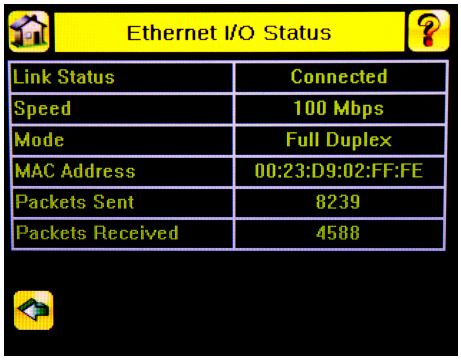


5. If the Link Status indicates that there is no link, please inspect the wiring, and verify that your Ethernet switch is powered up.
6. If the link parameters are not as expected (wrong baud rate or duplex) try the following:
    a. Log into your managed switch and verify that the port to which iVu camera is connected is correctly configured. Alternatively, consult with your IT person to perform this verification.
    b. Verify that your cable is of the right type, and is properly connected to the switch and to the camera.

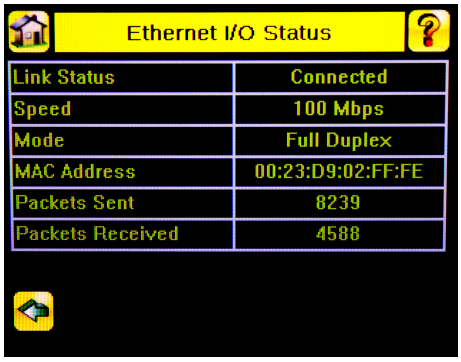
9.2 Networking and TCP/IP Diagnostics

To verify networking and TCP/IP connectivity, follow these steps:

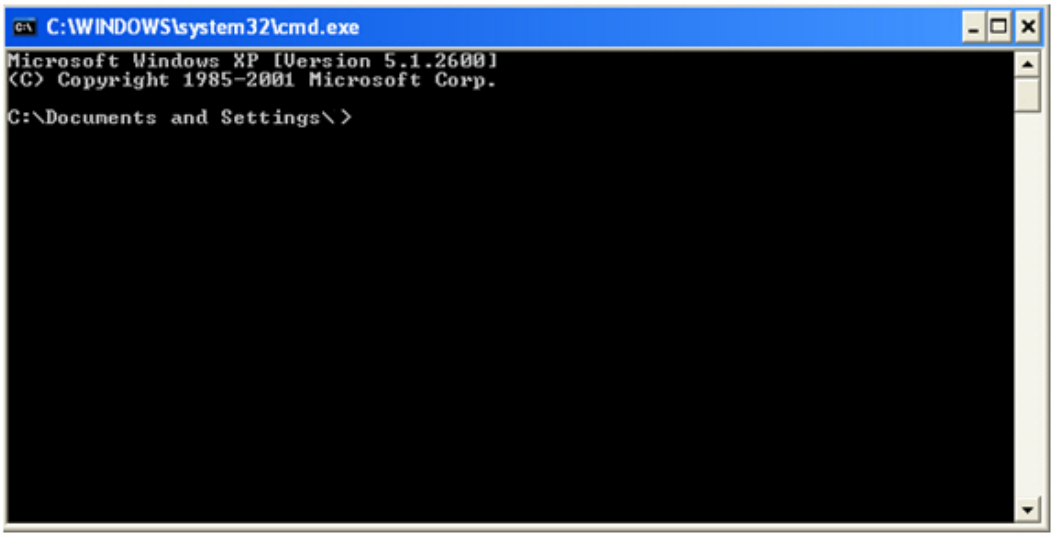
1. Verify that the Ethernet link has been established.
2. Visit the System > Communications > Ethernet I/O page, and examine the sensor IP address, subnet mask, and the Gateway address:



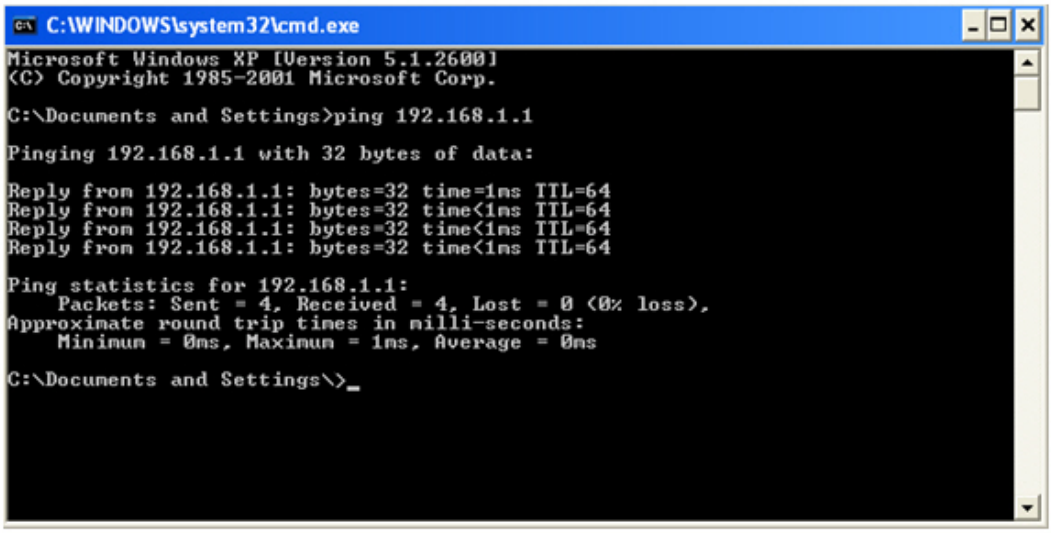
3. Verify with your IT person that these settings are correct.
    - If necessary, make the required modifications and reboot the sensor
4. Press the Status button on the same page, and go to the Ethernet I/O Status page:



5. On the PC attached to your LAN, open the Command window. To do this, press Start > Run, and then type in *cmd* and press the OK button.
6. A command window will display:



7. Type in a ping command, specifying the sensor IP address as an argument. You should see a series of responses from the camera:



8. You should also see the Packets Received and Packets Sent count on the Ethernet I/O Status page in the camera increment by at least 4.
9. If the output of the ping command shows request timeouts, try the following:
    - Verify that the camera is located on the correct subnet, has the correct IP address, and is connected to the correct switch or router.
    - If you are running several overlapping subnets, you may want to consult your IT person to ensure that the routing for the network is configured correctly.
    - If you are trying to access the camera through a gateway or a VPN router, please verify that these devices are configured such that they allow traffic from iVu camera to reach the destination device.

9.3 Industrial Protocols Troubleshooting

9.3.1 Modbus/TCP Protocol

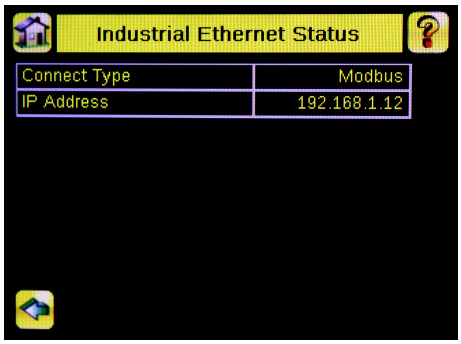
Modbus/TCP protocol relies on the fundamental TCP/IP connectivity to establish connections and transport data. Once you have verified Networking and TCP/IP connectivity, you should have little or no problems establishing a Modbus/TCP connection.

iVu supports one Modbus/TCP connection from a single client, and will reject additional connection requests.

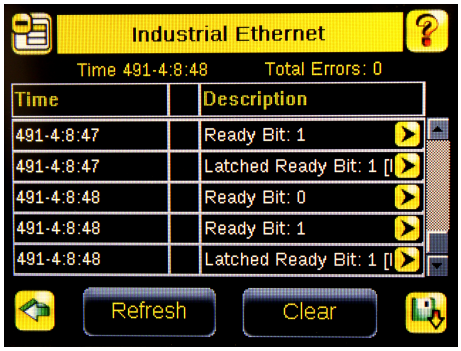
Prior to attempting to establish the Modbus/TCP connection, you will have to configure your device, and teach it about the iVu sensor. You will have to tell it the IP address of the iVu sensor that you have previously configured. Configurations steps vary for each device, so you will have to consult the appropriate manual for these steps.

If your device has user-configurable Modbus/TCP port, please verify that it is set to port number 502. iVu will not accept connections on any other port.

Once you have established a Modbus/TCP connection, you can verify that iVu has accepted it by going to the System > Communications > Industrial Ethernet > Status page, and viewing the connection status:



If you experience issues accessing data, please consult the relevant sections of the manual for the Modbus/TCP register maps supported by the sensor, and consult the Industrial Protocols Log. The log, when configured to Detailed Logging mode, provides record of individual register access sequence, and records any errors:



9.3.2 EtherNet/IP and PCCC Protocols

EtherNet/IP and PCCC protocols rely on CIP protocol to establish communications and exchange data. CIP protocol, in turn, utilizes TCP/IP.

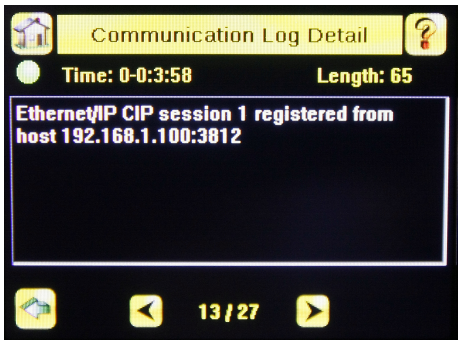
In addition, EtherNet/IP implements I/O messaging. I/O messaging allows two devices, iVu sensor and the PLC, to continuously synchronize data sets between each other. These data sets are called Input and Output Assemblies. iVu device consumes PLC output assemblies, and produces PLC input assemblies. This exchange occurs continuously, and the rate specified by the RPI (requested Packet Interval) value.

I/O messaging is based on UDP/IP, and utilizes Multicast addressing when sending PLC input assemblies. It is the default mode of operation for I/O messages in PLCs. Newer PLCs also support Unicast (direct) addressing for PLC input assemblies, but need to be specially configured.

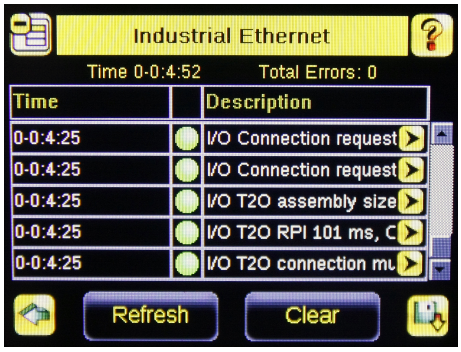
Because I/O messaging uses IDP/IP and Multicast, it requires special, managed switches, and customized switch configuration. Managed switches, when properly configured, prevent multicast devices from flooding the network with data. Please consult your IT person to make sure that you have the correct switch type, and that these switches have IGMP snooping enabled, to allow them to manage multicast groups.

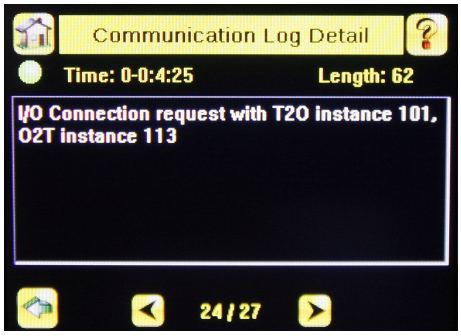
In addition, some switches with built-in firewalls block UDP traffic by default. If this is the case, and if the path between your devices involves several switches or routers, it is possible that some of them might block the UDP traffic necessary for I/O messages. Please consult your IT person to verify that your network is configured correctly. Also consult Rockwell publications ENET-AP001D-EN-P, *EtherNet/IP Performance*, and ENET-SO001A-EN-E, *EtherNet Design Considerations for Control System Networks* for further information on how to configure your EtherNet network for EtherNet/IP.

Establishing CIP and EtherNet/IP I/O communications is a complicated process. There are a number of steps during which an error can occur. Industrial Protocols log contains a detail description of the communications process, and should be consulted if any errors are suspected.

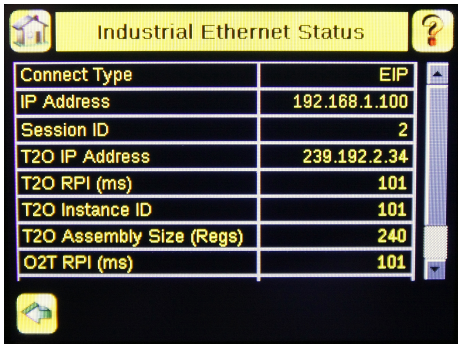


A great level of detail is also provided in the log when the I/O connection is established:





After the CIP and I/O connections are established, the Industrial Protocols Status page will show the details of the connection:



Most of the errors in establishing the CIP and I/O connections have to do with specifying the proper Input and Output assembly IDs and sizes. Please refer to the appropriate sections of this manual for this information.

10 Additional Information

10.1 iVu Command Channel Commands (iVu Command Channel over Industrial EtherNet)

This section describes how to use the iVu Command Channel over Industrial EtherNet. Please see the iVu Plus Communications User's Guide for more information on the iVu Command Channel protocol. The following commands need to be executed using the Command ID register and the Command Input bit/Input Coil bit.

Command	Command ID			Description	Data Type
	Do	Set	Get		
Trigger					
Trigger Mode		1	10001	The sensor's triggering mode. This value must match the modes supported by the sensor	Int16
Product Change					
Product Change By Name	21			This command forces the sensor to switch to the specified inspection. The sensor does not transmit a response until the sensor has completed the action. Inspections results immediately after a product change will be invalid until a new trigger is received.	Byte Array
Imager					
Gain		51	10051	The sensor's value used to electronically brighten all image pixels	Int32
Exposure		52	10052	The sensor's value used to control the amount of time the imager is allowed to gather light for the image.	Int32
Status					
Clear System Error	81			This command clears the system error LED and resets the internal system error flag to false.	N/A
System					
Reboot Sensor	101			This command reboots the sensor. If sensor configuration data is being currently being saved, this command will block until that operation completes	N/A
Save Configuration	102			This command saves all modified inspection and configuration parameters. This command blocks until all values have been persisted	N/A
Info					
Sensor Name			10151	Sensor user assignable name.	Byte Array
Model Number			10152	Sensor model number	Byte Array
Serial Number			10153	Sensor serial number	Byte Array
Firmware Version			10154	Sensor firmware (software) version	Byte Array
Hour Counter			10155	The total number of hours the sensor has been energized.	Byte Array
History					
Clear History	301			This command clears all history fields for the active inspection. History values include pass count, fail count, execution times and sensor specific history values.	N/A
Inspection					
Inspection Name			10501	The name of the active inspection.	Byte Array
BCR inputs					
Compare String			11001	The Barcode inspection compare data string. This string must start and end with the double quote character	Byte Array

Command	Command ID			Description	Data Type
	Do	Set	Get		
Compare Mask			11002	The Barcode inspection compare string mask in binary format; that is, masked characters are indicated by a "1" and unmasked characters are "0." Note that the mask character string must match the length of the compare string	Byte Array

Trigger Mode	1000	Description
External	1	Inspections will be initiated via the electrical trigger wire
Internal	2	Inspections will run continuously at the specified period (electrical trigger inputs are ignored)
FreeRun	3	Inspections will run continuously (electrical trigger inputs are ignored)
ExternalGated	4	Gated barcode inspection will be started and/or aborted via the electrical trigger wire
ContinuousScan	5	Inspections will run continuously (electrical trigger inputs are ignored)
IndustrialEtherNet	10	Inspections will only be trigged by Industrial EtherNet coils and commands.
Command	20	Inspections will only be trigged by the Command Channel trigger commands.

10.1.1 Error Codes

The iVu Plus sensor provides error codes in cases when commands failed to execute successfully. If such an error occurs, the Execution Error flag is set in the Output Bits/Status Register. When this bit is set, read the Error Code register to know the reason of failure. Below is the list of error codes:

Numeric ID	Text ID	Description
0	SUCCESS	Command processed successfully.
500	IE_TRIGGER_MODE_EXPECTED	The Trigger Mode must be set to 'Industrial Ethernet' to perform this operation.
510	IE_COMMAND_NOT_FOUND	The numeric Command ID specified was not found.
520	IE_COIL_ACTION_FAILED	The coil action resulted in a failure.
521	IE_COIL_ALREADY_BUSY	The coil was asserted before previous execution completed.
522	IE_COIL_NOT_FINISHED	The coil was de-asserted prior to execution completing.
523	IE_COIL_ANOTHER_ACTION_PENDING	The coil was asserted prior to another coil execution completing.
524	IE_COIL_MULTIPLES_DETECTED	Multiple coils were asserted simultaneously.
525	IE_COIL_ACK_INHIBITED	The coil action's output ACK was inhibited because the input coil was no longer set.
00000	SUCCESS	Command processed successfully
10000	EMPTY_FRAME_RECEIVED	Indicates that the request was empty. The command channel requires a command, any arguments, and an end-of-frame delimiter.
10001	COMMAND_NOT_RECOGNIZED	The command specified is not recognized
10100	GROUP_MISSING	A Group ID must be specified immediately after the command
10101	GROUP_NOT_FOUND	The specified Group ID is invalid / unknown
10102	GROUP_ITEM_MISSING	A Group Item ID must be specified immediately after the Group ID
10103	GROUP_ITEM_NOT_FOUND	The specified Group Item ID is invalid / unknown
10152	NOT_READABLE	Attempt to get a value that is not readable
10153	NOT_WRITEABLE	Attempt to set a value that is not writeable

Numeric ID	Text ID	Description
10250	NOT_A_METHOD	Method ID specified is not a method
10251	WRONG_ARGUMENT_COUNT	Total method arguments specified do not match method
10252	COMMAND_NOT_FINISHED	Attempt to issue command when a previous command has not finished
10300	INVALID_ARGUMENT_TYPE	Item ID specified must be a item (not a group or method)
10301	DATA_VALUE_MISSING	Command missing item's data value
10340	MINIMUM_VALUE_EXCEEDED	New item value is below the minimum
10341	MAXIMUM_VALUE_EXCEEDED	New items value is above the maximum
10350	ARGUMENTS_DETECTED	Get command received with unneeded arguments
10351	INVALID_ARGUMENT_TYPE	Item ID specified must be a item (not a group or method)
10500	DATA_SET_EMPTY	Data export operation returned no results.
10900	SENSOR_NOT_READY	Command specified requires sensor to be in the READY state.
10920	SENSOR_TYPE_NOT_ACTIVE	Command specified belongs to a different sensor type. Command refers to a inactive sensor type.
10950	DEVICE_TYPE_INVALID	Command not supported on this device type.
15000	VALUE_INVALID	Text value is invalid / unknown
15050	VALUE_INVALID	Text value is invalid - expecting True or False
15100	STRING_TOO_LONG	String value specified exceeds maximum allowable length
20002	COMPARE_DATA_DISABLED	Operation requires Barcode compare to be enabled
20003	COMPARE_MASK_INVALID	Compare mask invalid. Expecting string of 1's and 0's with length equal to compare data string
20004	NUMBER_TO_FIND_NOT_ONE	Barcode number to find must be set to one for this operation.
20005	COMPARE_MASK_DISABLED	Operation requires Barcode compare mask to be enabled.
20200	NO_AREAS_FOUND	Attempt to obtain value when no areas were found.
20600	NO_MATCHES_FOUND	Attempt to obtain value when no matches were found.
20800	NO_MATCHES_FOUND	Attempt to obtain value when no sort patterns were found.
80000	REMOTE_DISPLAY_NOT_CONNECTED	Remote Display must be connected to obtain this value
80001	REMOTE_DISPLAY_NOT_SUPPORTED	This sensor does not have Remote Display capability
80100	COMMAND_MODE_EXPECTED	The Trigger Mode must be set to "Command" perform this operation
80101	COMMAND_TIMED_OUT	The command timed out before finishing
80102	TRIGGER_REQUIRED	Access to the specified data requires a triggered inspection
80150	COMMAND_TIMED_OUT	The command timed out before finishing
80200	SYSTEM_ERROR_NOT_ACTIVE	The System Error must be active to execute this command
80300	TEACH_SENSOR_TYPE_INVALID	Teach requires Match Sensor type.
80350	MULTIPLE_INSPECTIONS_DISABLED	Requires multiple inspections to be enabled
80351	MULTIPLE_INSPECTIONS_EMPTY	No inspections are available in multiple inspection mode.
80400	PRODUCT_CHANGE_WHEN_NOT_READY	Sensor must be in the READY state to perform a product change.
80401	PRODUCT_CHANGE_INVALID_INSPECTION	Attempt to product change to a unknown or invalid inspection.
80402	PRODUCT_CHANGE_TIMEOUT	The Product Change operation timed out.
80403	PRODUCT_CHANGE_TO_SAME_INSPECTION	Attempt to product change to the same inspection.
80404	SENSOR_NAME_NOT_FOUND	Attempt to use a command without a sensor name in a multi-sensor inspection

10.1.2 Examples of Operation

The following examples show how the iVu Command Channel can be utilized via the Industrial Ethernet connection.

Clear System Error

1. Write the number 81 as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).

Get/Set Trigger Mode

Get the current Trigger Mode from the iVu Plus.

1. Write the number 10001 as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). Read the current Trigger Mode value in the Command Response Int16 register.

iVu model	Trigger Mode	Int16 value
TG, BCR	External	1
TG	Internal	2
TG	Free Run	3
TG, BCR	Industrial EtherNet Only	10
TG, BCR	Command	20
BCR	Continuous Scan	5
BCR	External Gated	4

Set the desired Trigger Mode for the iVu Plus:

1. Write the number 1 as a 16-bit integer into the Command ID register.
2. Write the desired Trigger Mode's Int16 value from the above table into the Command Parameter Int16 register.
3. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
4. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
5. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
6. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).

Set New Barcode Compare String

This procedure assumes that the Data Compare feature is enabled (found in the Inspection menu for the iVu Plus BCR).

1. Write the number 11001 as a 16-bit integer into the Command ID register.
2. Fill in the Command Parameters String registers with the ASCII data to be used as the new barcode compare string.
3. Write a 32-bit integer value equal to the number of ASCII characters present in the new barcode compare string data into the Command Parameter String Length register.
4. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
5. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
6. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
7. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). The new barcode compare string will be utilized for the next inspection.

Get/Set Exposure Time

Get the current Exposure Time from the iVu Plus.

1. Write the number 10052 as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). Read the current Exposure Time value (in microseconds) in the Command Response Int32 register.

Set the desired Exposure Time for the iVu Plus.

1. Write the number 52 as a 16-bit integer into the Command ID register.
2. Write the desired Exposure Time (in microseconds) as a 32-bit integer value into the Command Parameter Int32 register. The minimum acceptable value is 117 usec and the maximum value is 1,000,000 usec.
3. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
4. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
5. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
6. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register). The new exposure time will be used for the next inspection. Please note that this value is not saved to the iVu's permanent memory unless the Save Configuration task is completed.

Save iVu Configuration

This command saves all modified inspection and configuration parameters to the iVu Plus, including Command Channel changes to exposure time and gain, trigger mode, barcode compare string and/or mask, and Remote Teach sessions.

1. Write the number 102 as a 16-bit integer into the Command ID register.
2. Toggle the Command bit from 0 to 1 (bit 15 in the Input Bits/Input Coil Bits register).
3. Wait for the Command ACK flag to go from 0 to 1 (bit 15 in the Input Bits ACK/Input Coil Bits ACK register).
4. Verify that the Execution Error flag is not set (i.e. value should be 0). This is bit 15 in the Output Bits/Status Coil Bits register. If the value is 1, read the Error Code register for more information.
5. Task Complete. Toggle the Command bit back to 0 (bit 15 in the Input Bits/Input Coil Bits register).