SIMCO ION™
An ITW Company

IQ Power™ Control Station PROFINET IO

INTERFACE SPECIFICATION
(IQCS V7.0 and higher)

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1. OVERVIEW

IQ Power Control Station (CS)

The Simco-Ion IQ Power Control Station (CS) provides a power, communication and control hub for IQ Power and IQ Easy static neutralizing and sensing devices. The system control offered by the Control Station allows for integration of IQ Easy Static Sensors and IQ Easy Static Neutralizing Bars with the IQ Power system.

The Control Station will also provide network connectivity for a variety of fieldbus communication protocols such as EtherNet/IP, PROFIBUS DP-V1, PROFINET IO, Modbus RTU, Modbus TCP, DeviceNet and ControlNet by use of an HMS Industrial Network Anybus Module.

This document will outline the real-time status that is available from the IQ Power system for users that may want to monitor and/or record process data via their network.

IQ Power - Power Supply (BPS /BPS-C / HL / HLC)

A Simco-Ion IQ Power - Power Supply (BPS /BPS-C / HL / HLC) will provide the output power for a static neutralizer and process all of the system intelligence to maintain complete static control. The power supply will report its data as a "device".

IQ Easy / IQ Easy LP Neutralizer Bar

The Control Station may also integrate IQ Easy and IQ Easy LP Neutralizing Bars with the IQ Power system. Both the Power Supplies and IQ Easy / IQ Easy LP Static Neutralizing Bars will report their data as a "device".

IQ Power Fantom Blower

An IQ Power Fantom ionized air blower provides ionized air for static neutralization. The blower will report its data as a "device". A Fantom blower connected to a Control Station will still need to be connected to line voltage due to power requirements of the air blower.

IQ Easy Modular Sensor / IQ Power HL Sensor

When an IQ Easy Modular Sensor or IQ Power HL Sensor is paired with a neutralizer, the data will report as "device (neutralizer) with static sensor". If a Sensor is not paired with a neutralizer, the data report as "device sensor only".

IQ Power Network Verification

The Control Station is designed to allow users to verify network connectivity to the process data buffer.

The Application Data Instance (ADI) map includes several known process data bytes that can be used to verify High Byte (HB) & Low Byte (LB) data alignment on the bus and the start/end of buffer markers. Refer to ADI map for details on the location of the Start-Of-Buffer 'NPDV4321' and End-Of-Buffer 'NPDV6789' markers.

Technical Information

Technical information for the specific Anybus® CompactCom module is available from the Anybus HMS Industrial Networks web site. For the **M30** series module **#AB6215**, go to –

https://www.hms-networks.com/p/ab6215-b-anybus-compactcom-30-module-profinet-io

General and specific file documentation for this PROFINET IO Anybus® module should be available. This includes software design guides, driver packages, help documents, configuration utilities, network interface specific information (appendix documents) and other technical support information. If the above link does not provide the required information, contact customer support at Anybus. Assistance is also available through Simco-Ion customer support.

2. PROFINET IO

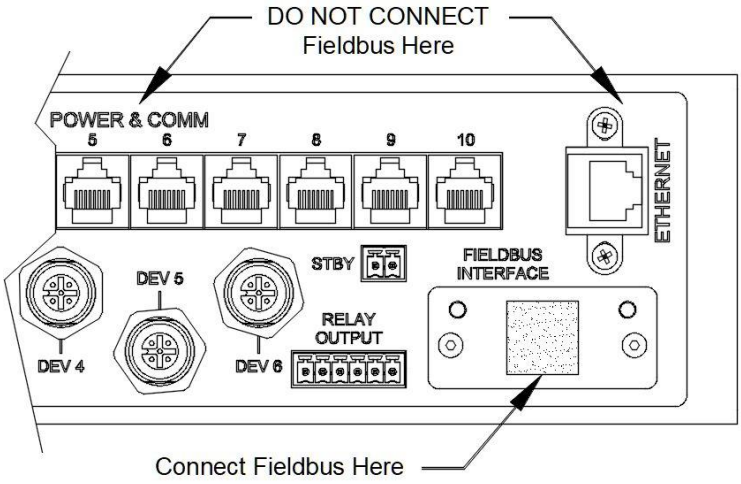
PROFINET IO Overview

The IQ Power Control Station will provide network connectivity with a PROFINET IO fieldbus protocol. The PROFINET IO interface supports 10/100Mbit, full or half duplex operation.

This document will outline the real-time status that is available from the IQ Power system for users that may want to monitor and/or record process data via their network.

PROFINET IO Interface: HMS Anybus Module #AB6215

The fieldbus interface is integrated into the IQ Power Control Station is the HMS Anybus CompactCom (ABCC) module #AB6215. Additional technical information for the hardware and supplemental software is available at the website: www.AnyBus.com.



On PROFINET IO, the characteristics of a device are stored in an XML data file. This file, referred to as the 'GSD'-file, is used by PROFINET IO engineering tools when setting up the network configuration. HMS Anybus provides a generic GSD-file which corresponds to the default settings in the module.

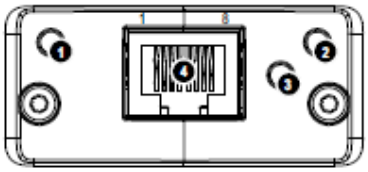
A sample listing of available files on the HMS Anybus website:

Program Files		
Anybus IPconfig - Utility for module TCP/IP configuration (Win 2000/XP/Vista/7 (32/64-bit)	3.0.1.5	1 006,26 kb
Configuration Files		
GSDML files	-	14,75 kb
Application Files		
How to configure an Anybus PROFINET IO Device module with a Siemens Step7 PLC	1.11	1 786,10 kb

The user should also download "Anybus IP Config Utility Program" from the website to change the IP address of their PROFINET IO module if necessary. Default web pages are also available for Network Information, Configuration, and Statistics.

PROFINET IO Network Interface Connector

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity LED
4	Ethernet Interface



Network Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Offline	- No power - No connection with IO Controller
Green	Online (RUN)	- Connection with IO Controller established - IO Controller in RUN state
Green, flashing	Online (STOP)	- Connection with IO Controller established - IO Controller in STOP state

Module Status LED

Note: A test sequence is performed on this LED during startup.

LED State	Description	Comments
Off	Not Initialized	No power - *or* - Module in 'SETUP' or 'NW_INIT' state
Green	Normal Operation	Module has shifted from the 'NW_INIT' state
Green, 1 flash	Diagnostic Event(s)	Diagnostic event(s) present
Green, 2 flashes	Blink	Used by engineering tools to identify the node on the network
Red	Exception Error	Module in state 'EXCEPTION'
Red, 1 flash	Configuration Error	Expected Identification differs from Real Identification
Red, 2 flashes	IP Address Error	IP address not set
Red, 3 flashes	Station Name Error	Station Name not set
Red, 4 flashes	Internal Error	Module has encountered a major internal error

LINK/Activity LED

LED State	Description	Comments
Off	No Link	No link, no communication present
Green	Link	Ethernet link established, no communication present
Green, flickering	Activity	Ethernet link established, communication present

Ethernet Interface

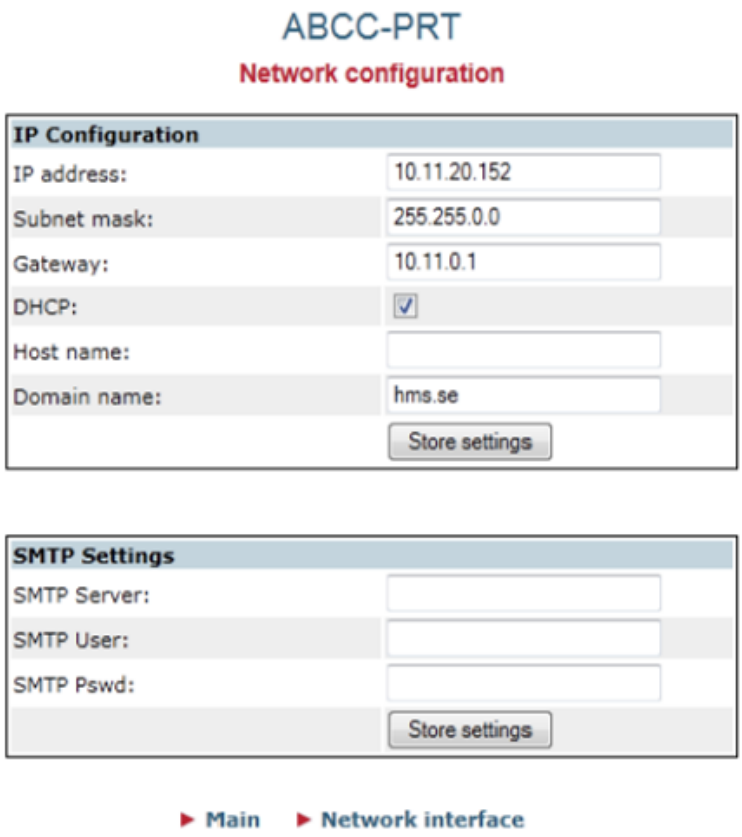
The Ethernet interface operates at 100 Mbit, full duplex, with autonegotiation enabled as default.

IMPORTANT:

For information on how to connect the PROFINET cable, see "Protective Earth (PE) Requirements" on page 150.

PROFINET IO Configuration

A sample snapshot of a web page browser to view the PROFINET IO module is shown below:

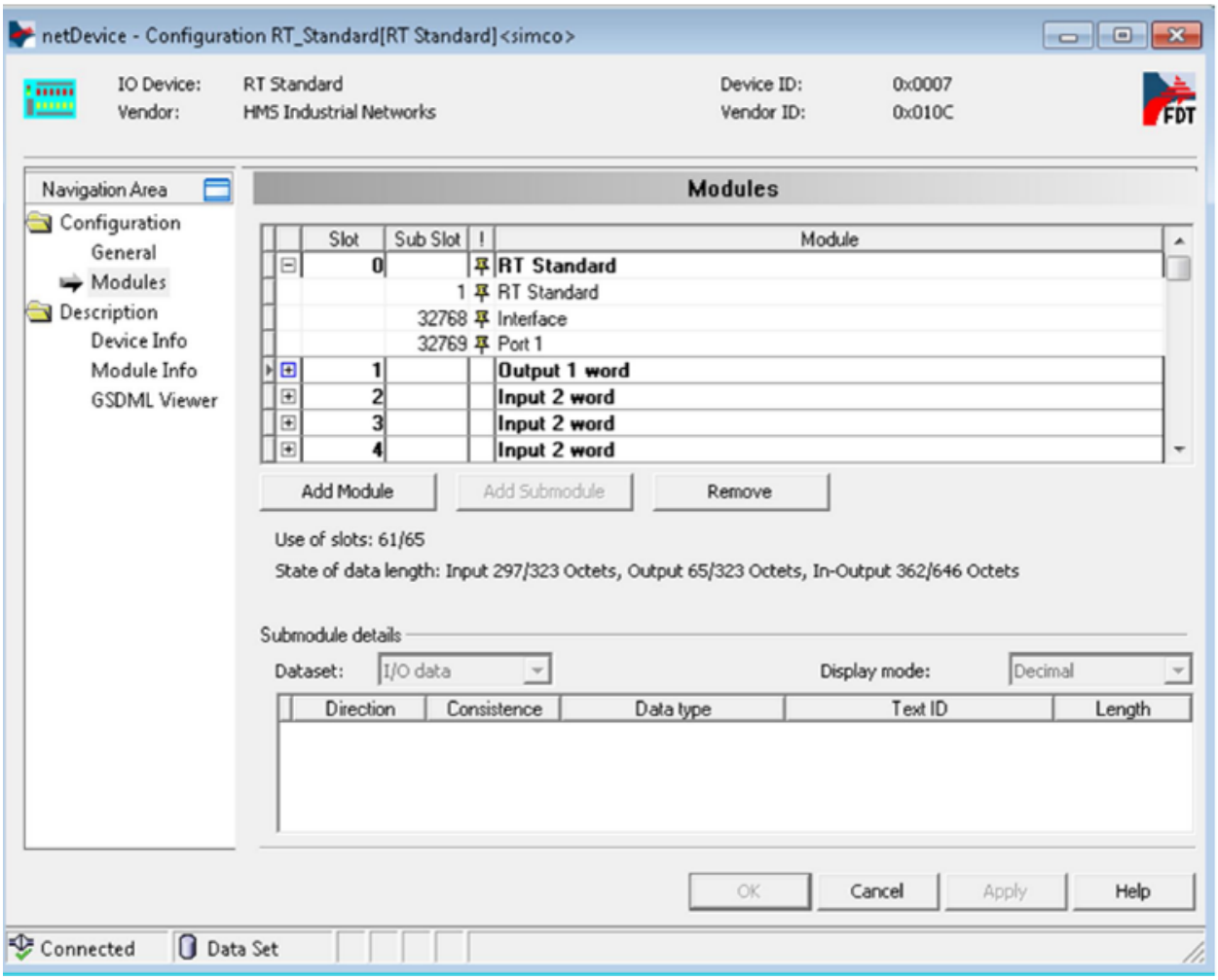


The network configuration page provides an interface for changing TCP/IP and SMTP settings in the Network Configuration Object.

The PROFINET IO module needs a reset for the changes to take effect.

System Configuration

The Anybus CompactCom (ABCC) module can be configured using the standard GSD file provided on the HMS Anybus website. The GSD file will define 3 device profiles. Select “RT_Standard”. Once the GSD file is loaded into the master, the input and output modules must be configured. Some networks limit the number of modules to 66, so each module is configured to hold 2 ADIs (4 bytes). Slot 0 must be a Data Access Point (DAP) with 3 submodules (See Image). This should automatically be defined and imported by the GSD file.

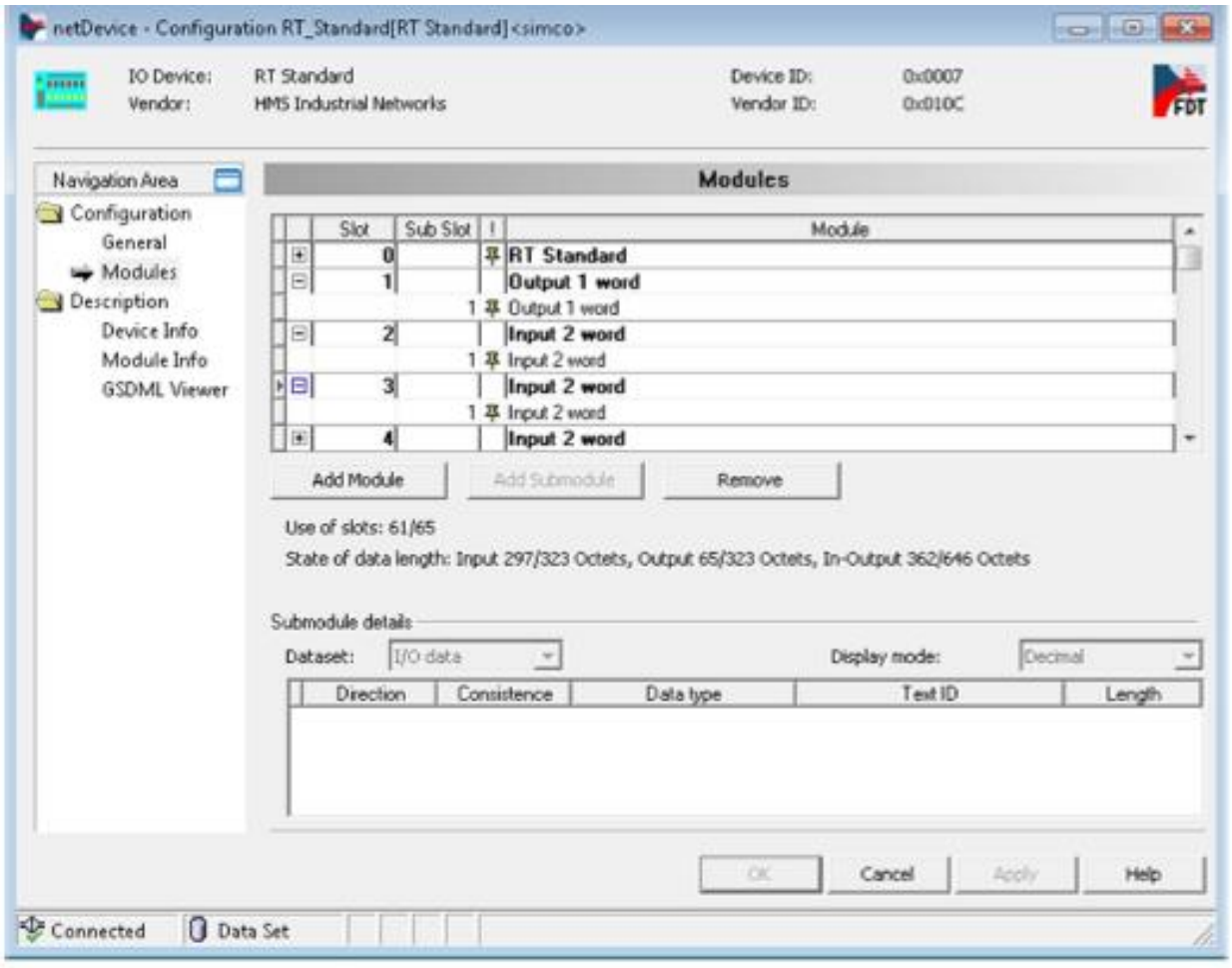


In order to connect, the configuration in the master must exactly match the configuration in the ABCC. If you have incorrectly configured the master, the Module Status LED on the ABCC will blink red 3 times (See Anybus-CC PROFINET IO Appendix for more info).

The proper configuration (shown in table) is:
Slot 0: DAP
Slot 1: Output 1 Word
Slot 2-59: Input 2 Words
Slot 60: Input 1 Word

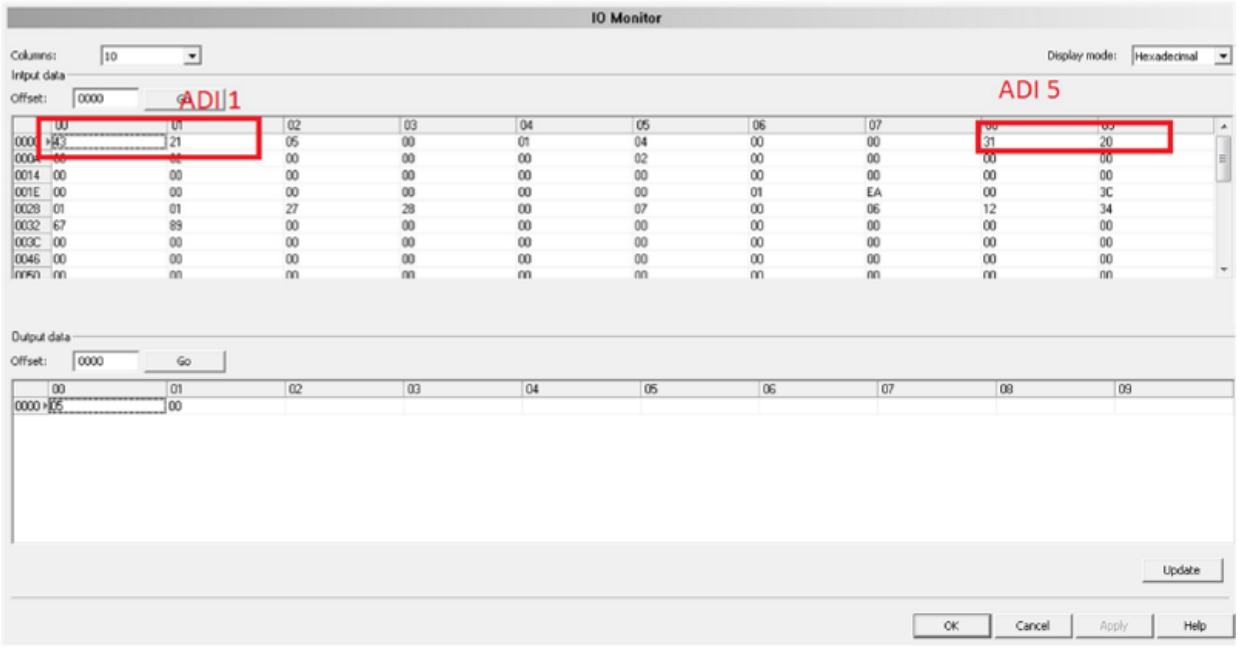
SLOT	MODULE
0	DAP
1	Input 1 Word
2	Output 2 Words
3	Output 2 Words
4	Output 2 Words
↓	↓
57	Output 2 Words
58	Output 2 Words
59	Output 2 Words
60	Output 1 Word

Each slot will contain the specified module with exactly one sub module (see image):



Once the device has been configured, download the configuration to the master and the device should connect. Note that you will need to set a service name for the module using a PROFINET tool such as *Sycon Ethernet Device Setup*. This module name that you set must match the module name you define in the master when you configure the device.

Example:



Programming Procedure

The user will be able to communicate with the PROFINET IO module to retrieve the process data from the system.

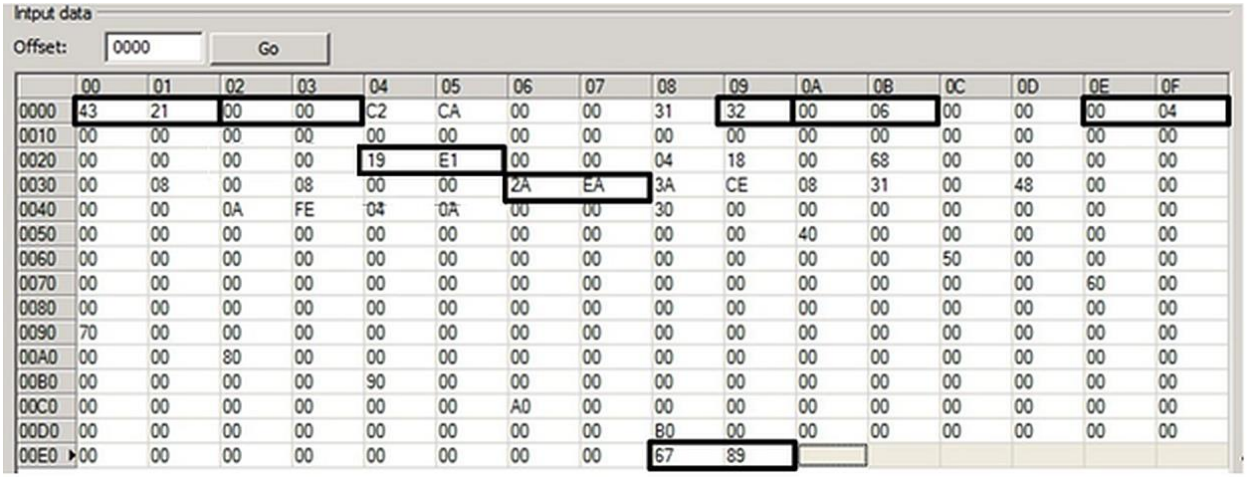
A typical procedure would be as follows:

1. Read **ADI#6** to determine which Devices are active in the system. An active Device will set the corresponding bit in ADI#6 if it powered "ON".
2. Read **ADI#7** to determine if any fault conditions exist in the system. Any non-zero value would indicate a fault exist in the system.
3. Read **ADI#8** to determine if any warning conditions exist in the system. A warning condition also includes service-type conditions such as "Clean Bar". Any non-zero value would indicate a warning condition exist in the system.

Process data for all ten (10) Devices can be monitored.

Process Data Buffer Examples

Example #1
(BPS, BPS-C, HL, HLC, IQ Easy, IQ Easy LP)


Intput data

Offset: 0000 Go

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0000	43	21	00	00	C2	CA	00	00	31	32	00	06	00	00	00	04
0010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0020	00	00	00	00	19	E1	00	00	04	18	00	68	00	00	00	00
0030	00	08	00	08	00	00	2A	EA	3A	CE	08	31	00	48	00	00
0040	00	00	0A	FE	04	0A	00	00	30	00	00	00	00	00	00	00
0050	00	00	00	00	00	00	00	00	00	00	40	00	00	00	00	00
0060	00	00	00	00	00	00	00	00	00	00	00	00	50	00	00	00
0070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	60	00
0080	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0090	70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00A0	00	00	80	00	00	00	00	00	00	00	00	00	00	00	00	00
00B0	00	00	00	00	90	00	00	00	00	00	00	00	00	00	00	00
00C0	00	00	00	00	00	00	A0	00	00	00	00	00	00	00	00	00
00D0	00	00	00	00	00	00	00	00	B0	00	00	00	00	00	00	00
00E0	00	00	00	00	00	00	00	00	67	89						

ADI#1 HB: 43 hex (Network Process Data Verification **High Byte**).
ADI#1 LB: 21 hex (Network Process Data Verification **Low Byte**).

ADI#2: 0000 hex (set Standby Mode / Run Mode, all devices set for Run Mode).
(ADI#2 is a unique register in that it is input only; all other registers are output only).

ADI#5 LB: 32 hex (Firmware Version **3.2**).

ADI#6: 0006 hex (Device "On/Off" Status indicates **Device#1** and **#2** are "ON", all others "OFF" or not connected).

ADI#8: 0004 hex (Device Warning Status indicates **Device#2** has a warning condition asserted).

ADI#19 HB: Device#1 Output Code = x9 hex (x = reserved bits, Output 90%).
ADI#19 LB: Device#1 Status Code = E1hex
(Power On, Comm On, Bar HV On, Speed Y On).

ADI#28 HB: Device#2 Output Code = xA hex (x = reserved bits, Output "High", e.g. 10).
ADI#28 LB: Device#2 Status Code = EA hex
(Power On, Comm On, Bar HV On, Clean Bar On, Hybrid Y On).

ADI#117 HB: 67 hex (Network Process Data Verification **High Byte**).
ADI#117 LB: 89 hex (Network Process Data Verification **Low Byte**).

Standby Mode

The high voltage for any neutralizing device may be turned off by placing the device in Standby Mode. Because there may be more than one input on a system that can place a device in Standby Mode, setting a device into standby or run mode is as follows: **ADI#2** is an input register that controls the setting of standby / run mode. A transition of the appropriate bit in this register from 0 to 1 will place that device into Standby Mode. Transitioning the bit from 1 to 0 will place the device in Run Mode. Based on the number of devices, it typically takes 2 to 10 seconds for the change of mode to take effect. The startup / default setting for this register is 0000 hex which is Run Mode. If the device is a Modular Sensor or HL Sensor Interface, changing the related bit will have no effect.

After a command is issued, the status of connected devices can be confirmed by checking the status of each individual device thru the corresponding device **Status Code B[5] Standby/Run status**, however it may take up to 30 seconds for the status to be changed and updated.

Sensor Module Web Voltage Calculation

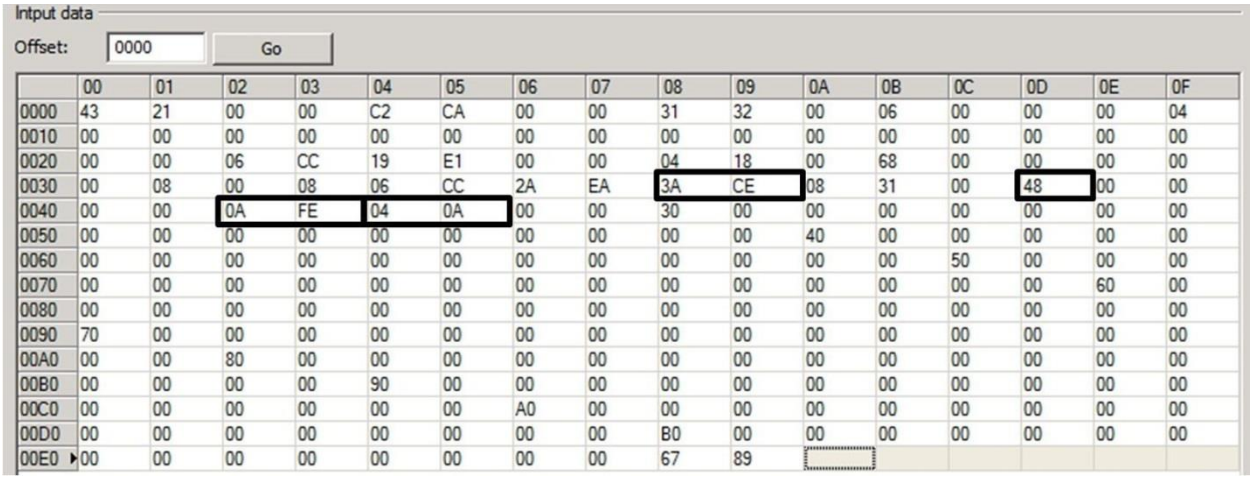
Web Voltage (WV#) data from each sensor module must be multiplied by a variable resolution to attain the actual web voltage. The value of the resolution depends on the maximum sensor module voltage range, which in turn depends on the sensor mounting distance. The resolution is variable in order to gain the greatest precision possible given the 8-bit transmission of the web voltage data.

Sensor Module Web Voltage Resolution

Mounting Distance (in.)	Operating Range (kV)	WV Resolution (V)
2	+/-20	156
3	+/-25	195
4	+/-30	234
6	+/-40	312
8	+/-50	390
10	+/-60	468

In this example, **Device#2** Neutralizer bar is paired with a Sensor Bar mounted at 2 inches has a max. operating range of +/- 20kV and the (decimal) resolution of the Web Voltage (WV#) data is **156.**

Example #2
(BPS, BPS-C, HL, HLC, IQ Easy, IQ Easy LP, with Sensor)


Intput data

Offset: 0000 Go

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0000	43	21	00	00	C2	CA	00	00	31	32	00	06	00	00	00	04
0010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0020	00	00	06	CC	19	E1	00	00	04	18	00	68	00	00	00	00
0030	00	08	00	08	06	CC	2A	EA	3A	CE	08	31	00	48	00	00
0040	00	00	0A	FE	04	0A	00	00	30	00	00	00	00	00	00	00
0050	00	00	00	00	00	00	00	00	00	00	40	00	00	00	00	00
0060	00	00	00	00	00	00	00	00	00	00	00	00	50	00	00	00
0070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	60	00
0080	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0090	70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00A0	00	00	80	00	00	00	00	00	00	00	00	00	00	00	00	00
00B0	00	00	00	00	90	00	00	00	00	00	00	00	00	00	00	00
00C0	00	00	00	00	00	00	A0	00	00	00	00	00	00	00	00	00
00D0	00	00	00	00	00	00	00	00	B0	00	00	00	00	00	00	00
00E0	00	00	00	00	00	00	00	00	67	89						

Web Voltage (WV#) data must be multiplied by WV Resolution, **156** in this case, to attain the actual web voltage:
ADI#29 HB: WV2 = 3A hex (58 decimal): **Actual** Web Voltage at sensor is 58 * **156**v = +9048 volts.
ADI#29 LB: WV1 = CE hex (-50 decimal): **Actual** Web Voltage at sensor is -50 * **156**v = -7800 volts.
ADI#31 LB: WV3 = 48 hex (72 decimal): **Actual** Web Voltage at sensor is 72 * **156**v = +11232 volts.

In this example, only **Sensor Module #3 [WV3]** has been enabled for Closed-Loop-Feedback (CLFB).
ADI#34: 0AFE hex (2814 decimal): Device#2 Feedback Average 2814 * 4 volts = +11256 volts.
ADI#35: 040A hex (1034 decimal): Device#2 Overall Average 1034 * 4 volts = +4136 volts.

Note that status data from your device will be different than that shown in this example.

Sensor module data is reported in a signed value which use a two's compliment representation.
For example, in signed 8-bit:
-2 decimal = FE hex = 1111 1110 binary
-1 decimal = FF hex = 1111 1111 binary
0 decimal = 00 hex = 0000 0000 binary
+1 decimal = 01 hex = 0000 0001 binary
+2 decimal = 02 hex = 0000 0010 binary
…
+126 decimal = 7E hex = 0111 1110 binary
+127 decimal = 7F hex = 0111 1111 binary
-128 decimal = 80 hex = 1000 0000 binary
-127 decimal = 81 hex = 1000 0001 binary

IQ Easy Modular Sensors may use WV1 thru WV4 when grouped in a single Control Station Address.
IQ Power HL Sensor may use WV1 thru WV8 when reporting thru a given HL Sensor Interface.
IQ Easy Sensor Bars (legacy installation) may use WV1 thru WV8.

Appendix A (Application Data Instance Map)

The Application Data Instance (ADI) Reference Table is a common reference for all interfaces.
ADI#: Application Data Instance Number (decimal)

ADI System

ADI# (decimal)	Slot / Module	Word	Definition
1	2	1	**Network Process Data Verification** Start-Of-Buffer marker used to verify network High/Low Byte alignment. [**HB**=0x43, **LB**=0x21]
2	2	2	Device **Standby Mode / Run Mode** Command [16-bit word] A transition state change for each bit will place the corresponding device into **Standby Mode or Run Mode**. B[15] thru B[11]: Reserved B[10]: Transition from 0 to 1 = Standby Mode [Device #10] B[10]: Transition from 1 to 0 = Run Mode [Device #10] B[9]: Transition from 0 to 1 = Standby Mode [Device #9] B[9]: Transition from 1 to 0 = Run Mode [Device #9] B[8]: Transition from 0 to 1 = Standby Mode [Device #8] B[8]: Transition from 1 to 0 = Run Mode [Device #8] B[7]: Transition from 0 to 1 = Standby Mode [Device #7] B[7]: Transition from 1 to 0 = Run Mode [Device #7] B[6]: Transition from 0 to 1 = Standby Mode [Device #6] B[6]: Transition from 1 to 0 = Run Mode [Device #6] B[5]: Transition from 0 to 1 = Standby Mode [Device #5] B[5]: Transition from 1 to 0 = Run Mode [Device #5] B[4]: Transition from 0 to 1 = Standby Mode [Device #4] B[4]: Transition from 1 to 0 = Run Mode [Device #4] B[3]: Transition from 0 to 1 = Standby Mode [Device #3] B[3]: Transition from 1 to 0 = Run Mode [Device #3] B[2]: Transition from 0 to 1 = Standby Mode [Device #2] B[2]: Transition from 1 to 0 = Run Mode [Device #2] B[1]: Transition from 0 to 1 = Standby Mode [Device #1] B[1]: Transition from 1 to 0 = Run Mode [Device #1] B[0]: Reserved Note: The bit state in **ADI#2** does NOT reflect the actual Standby/Run status of the device (e.g. IQ BPS, Easy Bar, etc)
3	3	1	Reserved
4	3	2	Reserved
5	4	1	Simco Product Identification & Firmware Version HB= Product ID (e.g. Communication Module=0x31) LB= Firmware Version (e.g. 0x75 = Version #7.5)

ADI Device Global

ADI# (decimal)	Slot / Module	Word	Definition
6	4	2	Device “On/Off” Status [16-bit word] B[15] thru B[11]: Reserved B[10]: 1 = “On”, 0 = “Off” or not connected (Device #10] B[9]: 1 = “On”, 0 = “Off” or not connected (Device #9) B[8]: 1 = “On”, 0 = “Off” or not connected (Device #8) B[7]: 1 = “On”, 0 = “Off” or not connected (Device #7) B[6]: 1 = “On”, 0 = “Off” or not connected (Device #6) B[5]: 1 = “On”, 0 = “Off” or not connected (Device #5) B[4]: 1 = “On”, 0 = “Off” or not connected (Device #4) B[3]: 1 = “On”, 0 = “Off” or not connected (Device #3)] B[2]: 1 = “On”, 0 = “Off” or not connected (Device #2) B[1]: 1 = “On”, 0 = “Off” or not connected (Device #1) B[0]: Reserved
7	5	1	Device “Fault”(red) Status [16-bit word] B[15] thru B[11]: Reserved B[10]: 1 = “Fault Active”, 0 = “no Fault”” (Device #10) B[9]: 1 = “Fault Active”, 0 = “no Fault” (Device #9) B[8]: 1 = “Fault Active”, 0 = “no Fault” (Device #8) B[7]: 1 = “Fault Active”, 0 = “no Fault” (Device #7) B[6]: 1 = “Fault Active”, 0 = “no Fault” (Device #6) B[5]: 1 = “Fault Active”, 0 = “no Fault” (Device #5) B[4]: 1 = “Fault Active”, 0 = “no Fault” (Device #4) B[3]: 1 = “Fault Active”, 0 = “no Fault” (Device #3) B[2]: 1 = “Fault Active”, 0 = “no Fault” (Device #2) B[1]: 1 = “Fault Active”, 0 = “no Fault” (Device #1) B[0]: Reserved
8	5	2	* Device “Warning”(yellow) Status [16-bit word] B[15] thru B[11]: Reserved B[10]: 1 = “Warning Active”, 0 = “no Warning”” (Device #10) B[9]: 1 = “Warning Active”, 0 = “no Warning” (Device #9) B[8]: 1 = “Warning Active”, 0 = “no Warning” (Device #8) B[7]: 1 = “Warning Active”, 0 = “no Warning” (Device #7) B[6]: 1 = “Warning Active”, 0 = “no Warning” (Device #6) B[5]: 1 = “Warning Active”, 0 = “no Warning” (Device #5) B[4]: 1 = “Warning Active”, 0 = “no Warning” (Device #4) B[3]: 1 = “Warning Active”, 0 = “no Warning” (Device #3) B[2]: 1 = “Warning Active”, 0 = “no Warning” (Device #2) B[1]: 1 = “Warning Active”, 0 = “no Warning” (Device #1) B[0]: Reserved

* If a device (neutralizer) has a “clean bar” alarm, it will assert a “warning”.

ADI Device 0 (Reserved / Not Applicable)

ADI# (decimal)	Slot / Module	Word	Definition
9	6	1	Reserved [16-bit]
10	6	2	Reserved [16-bit]
11	7	1	Reserved [16-bit]
12	7	2	Reserved [16-bit]
13	8	1	Reserved [16-bit]
14	8	2	Reserved [16-bit]
15	9	1	Reserved [16-bit]
16	9	2	Reserved [16-bit]
17	10	1	Reserved [16-bit]

ADI Device 1 thru 10 BPS, BPS-C, HL, HLC, IQ Easy, IQ Easy LP (<u>without</u> Sensor)

ADI# (decimal) Slot/Module - Word										Definition
Dev 1	**Dev 2**	**Dev 3**	**Dev 4**	**Dev 5**	**Dev 6**	**Dev 7**	**Dev 8**	**Dev 9**	**Dev 10**	
18 10-2	27 15-1	36 19-2	45 24-1	54 28-2	63 33-1	72 37-2	81 42-1	90 46-2	99 51-1	Reserved [16-bit]
19 11-1	28 15-2	37 20-1	46 24-2	55 29-1	64 33-2	73 38-1	82 42-2	91 47-1	100 51-2	B[15] thru B[12]: Reserved **Output Code** B[11,10,9,8]: A = Output "High" B[11,10,9,8]: 9 = Output 90% B[11,10,9,8]: 8 = Output 80% B[11,10,9,8]: 7 = Output 70% B[11,10,9,8]: 6 = Output 60% B[11,10,9,8]: 5 = Output 50% B[11,10,9,8]: 4 = Output 40% B[11,10,9,8]: 3 = Output 30% B[11,10,9,8]: 2 = Output 20% B[11,10,9,8]: 1= Output "Low" B[11,10,9,8]: 0=No output **Status Code** B[7]: 1 = Power ON, 0 = OFF B[6]: 1 = Comm ON, 0 = OFF B[5]: 1 = Bar HV ON (**Run Mode**), 0 = Bar HV OFF (**Standby Mode**) B[4]: 1 = Fault ON, 0 = OFF B[3]: 1 = Clean Bar ON, 0 = OFF B[2]: 1 = Distance Y, 0 = N B[1]: 1 = Hybrid Y, 0 = N B[0]: 1 = Speed Y, 0 =N
20 11-2	29 16-1	38 20-2	47 25-1	56 29-2	65 34-1	74 38-2	83 43-1	92 47-2	101 52-1	[signed 16-bit] / 4 = I Neutralization (uA). **Note: 1, 4**
21 12-1	30 16-2	39 21-1	48 25-2	57 30-1	66 34-2	75 39-1	84 43-2	93 48-1	102 52-2	Reserved [16-bit]
22 12-2	31 17-1	40 21-2	49 26-1	58 30-2	67 35-1	76 39-2	85 44-1	94 48-2	103 53-1	Reserved [16-bit]
23 13-1	32 17-2	41 22-1	50 26-2	59 31-1	68 35-2	77 40-1	86 44-2	95 49-1	0x68 53-2	Reserved [16-bit]
24 13-2	33 18-1	42 22-2	51 27-1	60 31-2	69 36-1	78 40-2	87 45-1	96 49-2	105 54-1	Reserved [16-bit]
25 14-1	34 18-2	43 23-1	52 27-2	61 32-1	70 36-2	79 41-1	88 45-2	97 50-1	106 54-2	I pos (uA) [16-bit]
26 14-2	35 19-1	44 23-2	53 28-1	62 32-2	71 37-1	80 41-2	89 46-1	98 50-2	107 55-1	I neg (uA) [16-bit]

ADI Device 1 thru 10 BPS, BPS-C, HL, HLC, IQ Easy, IQ Easy LP with Sensor (where device and sensor are paired AND use the same address)

ADI# (decimal) Slot/Module - Word										Definition
Dev 1	**Dev 2**	**Dev 3**	**Dev 4**	**Dev 5**	**Dev 6**	**Dev 7**	**Dev 8**	**Dev 9**	**Dev 10**	
18 10-2	27 15-1	36 19-2	45 24-1	54 28-2	63 33-1	72 37-2	81 42-1	90 46-2	99 51-1	I Positive (µA) [unsigned 16-bit]
19 11-1	28 15-2	37 20-1	46 24-2	55 29-1	64 33-2	73 38-1	82 42-2	91 47-1	100 51-2	B[15] thru B[12]: Reserved **Output Code** B[11,10,9,8]: A = Output "High" B[11,10,9,8]: 9 = Output 90% B[11,10,9,8]: 8 = Output 80% B[11,10,9,8]: 7 = Output 70% B[11,10,9,8]: 6 = Output 60% B[11,10,9,8]: 5 = Output 50% B[11,10,9,8]: 4 = Output 40% B[11,10,9,8]: 3 = Output 30% B[11,10,9,8]: 2 = Output 20% B[11,10,9,8]: 1= Output "Low" B[11,10,9,8]: 0=No output **Status Code** B[7]: 1 = Power ON, 0 = OFF B[6]: 1 = Comm ON, 0 = OFF B[5]: 1 = Bar HV ON (**Run Mode**), 0 = Bar HV OFF (**Standby Mode**) B[4]: 1 = Fault ON, 0 = OFF B[3]: 1 = Clean Bar / Warning ON, 0 = OFF B[2]: 1 = Distance Y, 0 = N B[1]: 1 = Hybrid Y , 0 = N B[0]: 1 = Speed Y , 0 =N
20 11-2	29 16-1	38 20-2	47 25-1	56 29-2	65 34-1	74 38-2	83 43-1	92 47-2	101 52-1	**HB**: WV2 (V), **LB**: WV1 (V) 2 signed 8-bit bytes] **Note: 1,3,5**
21 12-1	30 16-2	39 21-1	48 25-2	57 30-1	66 34-2	75 39-1	84 43-2	93 48-1	102 52-2	I Negative (µA) [unsigned 16-bit]
22 12-2	31 17-1	40 21-2	49 26-1	58 30-2	67 35-1	76 39-2	85 44-1	94 48-2	103 53-1	**HB**: WV4 (V), **LB**: WV3 (V) [2 signed 8-bit bytes] **Note: 1,3,5**
23 13-1	32 17-2	41 22-1	50 26-2	59 31-1	68 35-2	77 40-1	86 44-2	95 49-1	0x68 53-2	**HB**: WV6 (V), **LB**: WV5 (V) * [2 signed 8-bit bytes] **Note: 1,3,5**
24 13-2	33 18-1	42 22-2	51 27-1	60 31-2	69 36-1	78 40-2	87 45-1	96 49-2	105 54-1	**HB**: WV8 (V), **LB**: WV7(V) * [2 signed 8-bit bytes] **Note: 1,3,5**
25 14-1	34 18-2	43 23-1	52 27-2	61 32-1	70 36-2	79 41-1	88 45-2	97 50-1	106 54-2	[signed16-bit] x 4 = Feedback Average (V) **Note: 1,2**
26 14-2	35 19-1	44 23-2	53 28-1	62 32-2	71 37-1	80 41-2	89 46-1	98 50-2	107 55-1	[signed 16-bit] x 4 = Overall Average (V) **Note: 1,2**

* WV5 thru WV8 not used with IQ Easy Modular Sensor.

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ADI Device 1 thru 10 Fantom (<u>without</u> Modular Sensor)

ADI# (decimal) Slot/Module - Word										Definition
Dev 1	**Dev 2**	**Dev 3**	**Dev 4**	**Dev 5**	**Dev 6**	**Dev 7**	**Dev 8**	**Dev 9**	**Dev 10**	
18 10-2	27 15-1	36 19-2	45 24-1	54 28-2	63 33-1	72 37-2	81 42-1	90 46-2	99 51-1	**HB:** I Positive (µA) **LB:** I Negative (µA) [2-unsigned 8-bit bytes]
19 11-1	28 15-2	37 20-1	46 24-2	55 29-1	64 33-2	73 38-1	82 42-2	91 47-1	100 51-2	**HB:** Balance * (1 to 99) [unsigned 8-bit] **LB: Status Code** B[7]: 1 = Fixed Y, 0 = NO B[6]: 1 = Manual Narrow Y, 0 = NO B[5]: 1 = CLFB y, 0 = NO B[4]: 1 = Manual Wide Y, 0 = NO B[3]: 1 = HV & Fan ON (**Run Mode**) 0 = HV & Fan OFF (**Standby Mode**) B[2]: 1 = Fault (red LED) ON, 0 = OFF B[1]: 1 = Warning (yellow LED) ON, 0 = OFF B[0]: 1 = Power (green LED) ON, 0 = OFF
20 11-2	29 16-1	38 20-2	47 25-1	56 29-2	65 34-1	74 38-2	83 43-1	92 47-2	101 52-1	Reserved [16-bit]
21 12-1	30 16-2	39 21-1	48 25-2	57 30-1	66 34-2	75 39-1	84 43-2	93 48-1	102 52-2	**HB:** Positive Drive (%) **LB:** Negative Drive (%) [2 unsigned 8-bit bytes]
22 12-2	31 17-1	40 21-2	49 26-1	58 30-2	67 35-1	76 39-2	85 44-1	94 48-2	103 53-1	Reserved [16-bit]
23 13-1	32 17-2	41 22-1	50 26-2	59 31-1	68 35-2	77 40-1	86 44-2	95 49-1	0x68 53-2	Reserved [16-bit]
24 13-2	33 18-1	42 22-2	51 27-1	60 31-2	69 36-1	78 40-2	87 45-1	96 49-2	105 54-1	Reserved [16-bit]
25 14-1	34 18-2	43 23-1	52 27-2	61 32-1	70 36-2	79 41-1	88 45-2	97 50-1	106 54-2	Reserved [16-bit]
26 14-2	35 19-1	44 23-2	53 28-1	62 32-2	71 37-1	80 41-2	89 46-1	98 50-2	107 55-1	Reserved [16-bit]

* Balance: 50 ~ nominally balanced output, <50 ~ negative biased output, >50 ~ positive biased output.

ADI Device 1 thru 10 Fantom <u>with</u> Modular Sensor (where Fantom and sensor are paired AND <u>use the same address</u>)

ADI# (decimal) Slot/Module - Word										Definition
Dev 1	**Dev 2**	**Dev 3**	**Dev 4**	**Dev 5**	**Dev 6**	**Dev 7**	**Dev 8**	**Dev 9**	**Dev 10**	
18 10-2	27 15-1	36 19-2	45 24-1	54 28-2	63 33-1	72 37-2	81 42-1	90 46-2	99 51-1	**HB:** I Positive (µA) **LB:** I Negative (µA) [2-unsigned 8-bit bytes]
19 11-1	28 15-2	37 20-1	46 24-2	55 29-1	64 33-2	73 38-1	82 42-2	91 47-1	100 51-2	**HB:** Balance * (1 to 99) [unsigned 8-bit] **LB: Status Code** B[7]: 1 = Fixed Y, 0 = NO B[6]: 1 = Manual Narrow Y, 0 = NO B[5]: 1 = CLFB y, 0 = NO B[4]: 1 = Manual Wide Y, 0 = NO B[3]: 1 = HV & Fan ON (**Run Mode**) 0 = HV & Fan OFF (**Standby Mode**) B[2]: 1 = Fault (red LED) ON, 0 = OFF B[1]: 1 = Warning (yellow LED) ON, 0 = OFF B[0]: 1 = Power (green LED) ON, 0 = OFF
20 11-2	29 16-1	38 20-2	47 25-1	56 29-2	65 34-1	74 38-2	83 43-1	92 47-2	101 52-1	**HB**: WV2 (V), **LB**: WV1 (V) 2 signed 8-bit bytes] **Note: 1,3,5**
21 12-1	30 16-2	39 21-1	48 25-2	57 30-1	66 34-2	75 39-1	84 43-2	93 48-1	102 52-2	**HB:** Positive Drive (%) **LB:** Negative Drive (%) [2 unsigned 8-bit bytes]
22 12-2	31 17-1	40 21-2	49 26-1	58 30-2	67 35-1	76 39-2	85 44-1	94 48-2	103 53-1	**HB**: WV4 (V), **LB**: WV3 (V) [2 signed 8-bit bytes] **Note: 1,3,5**
23 13-1	32 17-2	41 22-1	50 26-2	59 31-1	68 35-2	77 40-1	86 44-2	95 49-1	0x68 53-2	Reserved [16-bit]
24 13-2	33 18-1	42 22-2	51 27-1	60 31-2	69 36-1	78 40-2	87 45-1	96 49-2	105 54-1	Reserved [16-bit]
25 14-1	34 18-2	43 23-1	52 27-2	61 32-1	70 36-2	79 41-1	88 45-2	97 50-1	106 54-2	[signed16-bit] x 4 = Feedback Average (V) **Note: 1,2**
26 14-2	35 19-1	44 23-2	53 28-1	62 32-2	71 37-1	80 41-2	89 46-1	98 50-2	107 55-1	[signed 16-bit] x 4 = Overall Average (V) **Note: 1,2**

* Balance: 50 ~ nominally balanced output, <50 ~ negative biased output, >50 ~ positive biased output.

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ADI Device 1 thru 10 Modular Sensor or HL Sensor Interface or Sensor Bar only (where sensor is the only device occupying a given address)

ADI# (decimal) Slot/Module - Word										Definition
Dev 1	**Dev 2**	**Dev 3**	**Dev 4**	**Dev 5**	**Dev 6**	**Dev 7**	**Dev 8**	**Dev 9**	**Dev 10**	
18 10-2	27 15-1	36 19-2	45 24-1	54 28-2	63 33-1	72 37-2	81 42-1	90 46-2	99 51-1	Reserved [16-bit]
19 11-1	28 15-2	37 20-1	46 24-2	55 29-1	64 33-2	73 38-1	82 42-2	91 47-1	100 51-2	**HB:** B[15] thru B[8]: Reserved **LB: Sensor / HL Sensor Interface Status Code** B[7]: 1 = Power ON, 0 = OFF B[6]: 1 = Comm ON, 0 = OFF B[5]: Reserved B[4]: 1 = Fault ON, 0 = OFF B[3]: 1 = Warning ON, 0 = OFF B[2]: Reserved B[1]: Reserved B[0]: Reserved
20 11-2	29 16-1	38 20-2	47 25-1	56 29-2	65 34-1	74 38-2	83 43-1	92 47-2	101 52-1	**HB**: WV2 (V), **LB**: WV1 (V) 2 signed 8-bit bytes] **Note: 1,3,5**
21 12-1	30 16-2	39 21-1	48 25-2	57 30-1	66 34-2	75 39-1	84 43-2	93 48-1	102 52-2	Reserved [16-bit]
22 12-2	31 17-1	40 21-2	49 26-1	58 30-2	67 35-1	76 39-2	85 44-1	94 48-2	103 53-1	**HB**: WV4 (V), **LB**: WV3 (V) [2 signed 8-bit bytes] **Note: 1,3,5**
23 13-1	32 17-2	41 22-1	50 26-2	59 31-1	68 35-2	77 40-1	86 44-2	95 49-1	0x68 53-2	**HB**: WV6 (V), **LB**: WV5 (V) * [2 signed 8-bit bytes] **Note: 1,3,5**
24 13-2	33 18-1	42 22-2	51 27-1	60 31-2	69 36-1	78 40-2	87 45-1	96 49-2	105 54-1	**HB**: WV8 (V), **LB**: WV7(V) * [2 signed 8-bit bytes] **Note: 1,3,5**
25 14-1	34 18-2	43 23-1	52 27-2	61 32-1	70 36-2	79 41-1	88 45-2	97 50-1	106 54-2	[signed 16-bit] x 4 = Feedback Average (V) **Note: 1, 2**
26 14-2	35 19-1	44 23-2	53 28-1	62 32-2	71 37-1	80 41-2	89 46-1	98 50-2	107 55-1	[signed 16-bit] x 4 = Overall Average (V) **Note: 1,2**

* WV5 thru WV8 not used with IQ Easy Modular Sensor.

Notes:

1. Signed values use a two's compliment representation.
2. ADI data value not valid if device is in 'Standby' mode **[Status Code B[5]: Standby/Run Mode]**.
3. Sensor Web Voltage (WV#) requires calculation, see Sensor Web Voltage Calculations
4. This value is not supported in Pulse Mode.
5. Refer to Appendix C for additional Sensor information (WVx).

ADI Device 11 (Reserved / Not Applicable)

ADI# (decimal)	Slot / Module	Word	Definition
108	55	2	Reserved [16-bit]
109	56	1	Reserved [16-bit]
110	56	2	Reserved [16-bit]
111	57	1	Reserved [16-bit]
112	57	2	Reserved [16-bit]
113	58	1	Reserved [16-bit]
114	58	2	Reserved [16-bit]
115	59	1	Reserved [16-bit]
116	59	2	Reserved [16-bit]

ADI System

ADI# (decimal)	Slot / Module	Word	Definition
117	60	1	**Network Process Data Verification** End-Of-Buffer marker used to verify network High/Low Byte alignment. [**HB**=0x67, **LB**=0x89]

Appendix B (Surface Charge Density Calculations)

IQ Power Control Station Calculations

The IQ Power neutralizer system continuously measures the neutralizing current I_n ($I_{Neutralization}$), alternately: $I_n = I_{Positive} - I_{Negative}$, and continuously calculates value of the initial web surface charge density and field intensity as:

Upstream

$$\sigma_{initial} = -\frac{K_{up} \cdot I_n}{\nu \cdot W} \quad , \text{ or} \quad E_{initial} = V_{up} = \frac{\sigma_{initial}}{\varepsilon_o} = -\frac{K_{up} \cdot I_n}{\varepsilon_o \cdot \nu \cdot W}$$

The residual web surface charge density and the residual field intensity are estimated as:

Downstream

$$\sigma_{residual} = \sigma_{initial} \cdot (1 - K_{dn}) \quad , \text{ or} \quad E_{residual} = V_{dn} = \frac{\sigma_{residual}}{\varepsilon_o}$$

σ – average charge density on the web, *coulombs/m*^{2}. For $\mu C/m^2$ multiply the number in coulombs/m^2 by 1,000,000.

E – electrical field intensity at surface of web, *V/m.* For *kV/cm* divide number *V/m* by 100,000.

I_n – absolute value of the neutralizing current from IQ Power neutralizer, *A*

Note: the absolute value is used for calculations; the sign is used for indicating the polarity of the initial charge on the web

K_{up} is determined by field meter (adjust K_{up} so V_{up} =field meter reading).

W - web width covered by the neutralizer (the shorter of the length of the first bar or the web width), *meters*

V_{dn} is measured by field meter to determine K_{dn}.

ν - web velocity, *meters per second*

ε_o = 8.8542 x 10^{-12} F/m (permittivity of free space)

$$K_{eff} = 1 - \frac{\text{residual charge}}{\text{initial charge}}$$

K_{eff} is the neutralizing efficiency whose value can range from 0.1 to 1.1. The actual value depends on the type of the neutralizer, its condition, its installation, distance to the web, and other variables.

- Complete neutralization: residual charge =0 and K = 1
- Incomplete neutralization: residual charge >0 and the original polarity, K<1
- Overcompensation: residual charge >0 and the opposite polarity, K>1

The K_{eff} could be set based on prior knowledge and some experimentation. with IQ Power neutralizers, when installed according to the instructions, and within the optimal range, have K_{eff}>0.9.

The K_{eff} should be a programmable value, initially set for IQ Power neutralizers at 0.9.

The K_{eff} can be determined using an electrostatic fieldmeter [very carefully, as fieldmeters are notoriously inaccurate and error-prone]. Consult with Simco-Ion for instructions for determining the constant K_{eff}.

Method application notes:

1. The method provides useful information when the material carries electrostatic charge of one polarity.
2. The surface charge density or field intensity values are displayed only when the HVPS is enabled and the Bar is on. Otherwise, "NA" should be displayed for all material charge values.
3. When there is any alarm condition, i.e. Short Circuit, Hardware, Clean Bar, or Communication Loss, "NA" should be displayed for all material charge values.
4. Use $\mu C/m^2$ as a unit of measurements for surface charge density. Multiply the readings in C/m^2 by 1,000,000 to get $\mu C/m^2$.
5. Use kV/cm as a unit of measurements for field intensity. Divide the readings in V/m by 100,000 to get kV/cm.
6. The method applies when the bar-to-material distance is generally constant, i.e. does not vary more than 2-3 inches (50-75 mm) during the measurements. In other words, the formulas would not apply when a bar is installed at a winder and if the distance to the roll changes, for example from 20 inches (500 mm) at the start of the roll to 3 inches (75 mm) at the finish.
7. The bar must be installed sufficiently away from any metal parts, rollers or machine frame cross members, so that the neutralizing current from the bar is less than 0.5 uA when the machine is not running and no material is present. However, if there are machine frame components or rollers, or other metal objects too close to the neutralizing bar, the neutralizing current values will be higher. The "background" neutralizing current could introduce unacceptable errors in the surface charge density calculations.
8. The bar must be installed within optimal operating range from the web.
9. The length of the bar cannot be shorter than the width of the web by more than two inches.
10. I_n = absolute value of the neutralizing current; the absolute value is used for calculations; the sign is used for indicating the polarity of the initial charge on the web.

Appendix C (Additional Sensor Information)

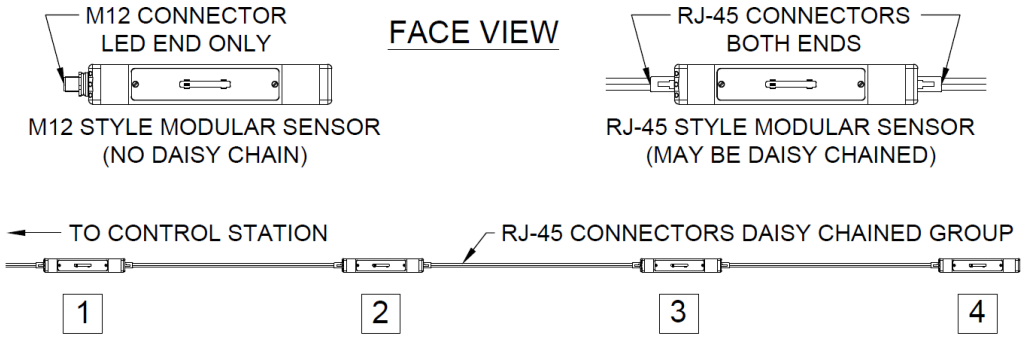
The description of the sensor values will vary based on the installation configuration, and the type of product connected to the IQ Power Control Station.

There are two (2) different sensor products offered by Simco-Ion:

1. IQ Easy Modular Sensor
2. IQ Power HL Sensor

Depending on installed equipment, the sensor values defined as Web Voltage (WV1 to WV4 or WV1 to WV8) in the ADI data mapping reflect voltage levels at a sensor module.

IQ Easy Modular Sensor



If the installation is a group of IQ Easy Modular Sensors under a single Control Station Address, WV1 up to WV4 may be available at that address. WV1 reflects the voltage level at SENSOR NUMBER 1. WV2 reflects the voltage level at SENSOR NUMBER 2. The sequential pattern continues for up to four (4) MODULAR SENSORS (WV1 to WV4).

Feedback Average is from <u>selected</u> Modular Sensors at a given Control Station Address.
Overall Average is from <u>all</u> Modular Sensors at a given Control Station Address.

[signed16-bit] x 4 = Feedback Average (V) **Note: 1,2**
[signed 16-bit] x 4 = Overall Average (V) **Note: 1,2**

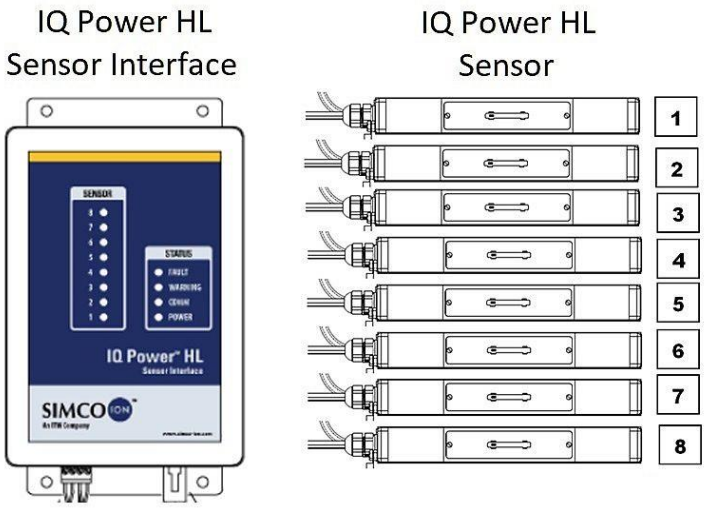
The PLC data buffer also includes a separate Overall and Feedback (CLFB) Average voltage value. The ADI mapping defines the location of these Average voltages in the PLC data buffer if applicable to the Fieldbus interface.

The IQ Power Control Station (CS) can connect up to ten (10) IQ Easy Modular Sensor Groups at device address 1 to 10. Four (4) IQ Easy Modular Sensors can be installed at each CS device address. ADI data mapping defines the PLC buffer location of each CS device address (1 to 10).

Refer to the Control Station or IQ Easy Modular Sensor manuals for additional information.

NOTE: IQ Easy Sensor Bar (legacy installation) up to WV8 may be available for the bar.

IQ Power HL Sensor



If the installation is an IQ Power HL Sensor Interface, each IQ Power HL Sensor is assigned a Sensor Number. The sensor number may be 1 through 8.
The IQ Power HL Sensor comes from the factory with a label on its cable identifying its assigned Sensor Number.

WV1 reflects the voltage level at HL Sensor labeled number 1.
WV2 reflects the voltage level at HL Sensor labeled number 2.
:
WV8 reflects the voltage level at HL Sensor labeled number 8.

A single IQ Power HL Sensor Interface can report the status data for up to eight (8) HL Sensors (if the HL Sensor is connected to the Sensor Interface).

[signed16-bit] x 4 = Feedback Average (V) **Note: 1,2**
[signed 16-bit] x 4 = Overall Average (V) **Note: 1,2**

The PLC data buffer also includes a separate Overall and Feedback (CLFB) Average voltage value. The ADI mapping defines the location of these Average voltages in the PLC data buffer if applicable to the Fieldbus interface.

The IQ Power Control Station (CS) can connect up to ten (10) IQ HL Sensor Interfaces at device address 1 to 10. One (1) IQ HL Sensor Interface can be installed at each CS device address. The ADI data mapping defines the PLC buffer location of each CS device address (1 to 10).

Refer to the Control Station or IQ Power HL Sensor manuals for additional information.

Revision History

Version	Date	Description
A	12/14/2018	Initial Release
B	1/4/2021	ECN 4152, Added IQ Easy LP
C	2/8/2021	ECN 4162 Added Fieldbus Connection Illustration & Appendix C
D	12/15/2021	ECN 4228, Updated Anybus Technical Information
E	11/27/2023	ECN 4388, Updated for IQ Easy Modular Sensor
F	7/15/2024	ECN 4429. Updated Anybus link, p. 2

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