Intrinsically Safe Intelligent Control Module™ (ICM™) Product

Commissioner Tool Manual

Swagelok

Contents

Introduction

The ICM Commissioner is a PC software application that allows a user to modify the configuration of the Swagelok ICM for initial system configuration or system maintenance. The ICM is a CANopen-compliant device, which means third party CANopen network configuration tools can be used to configure the ICM. However, these tools will likely not provide access to the ICM Embedded Script Processor, a unique and powerful feature of the ICM.

The ICM Commissioner will be hereafter referred to as the "ICM Commissioner" and the "Commissioner" interchangeably.

System Requirements

Supported operating systems	Windows® 7, 8.1, and 10 (x32 or x64 bit)
Download size	20 MB
Installed size	70 MB
.Net Framework	.NET 3.5
Program type	x86 (32 bit)
Language	English only
IXXAT® driver	VCI driver version 3.5.4268 (installed with ICM Commissioner)
Permissions	Administrative permissions are required to install the ICM Commissioner
Other requirements	IXXAT CAN adapter (USB-to-CAN v2 recommended)
	cable with 12 V (dc) power to connect CAN adapter to the ICM

Installing the ICM Commissioner

Note: It is necessary that the operator be logged in as an administrator on the device on which the ICM Commissioner is being installed.

To install the software:

1. Download the "Swagelok ICM Commissioner Installer.zip" file from www.swagelok.com.
2. Unzip the file.
3. Run "setup.exe" to launch the "Swagelok ICM Commissioner Setup Wizard".

Fig 1   Setup Wizard

The Setup Wizard will walk the user through the installation process. This process will include steps to review and accept the Software End User's License Agreement (EULA), and choose the installation location for the Commissioner.

Note: The standard Software End User's License Agreement will display. Any agreement negiotiated separately with Swagelok will supercede this document.

As the Commissioner installs, a separate installer will open to install the Virtual CAN Interface (VCI) driver. This driver allows the ICM Commissioner to communicate with the IXXAT CAN adapters which provide the mechanism to communicate via the CAN bus to the ICM.

The VCI Setup Wizard will require a restart of the computer before the installation is complete and available for use.
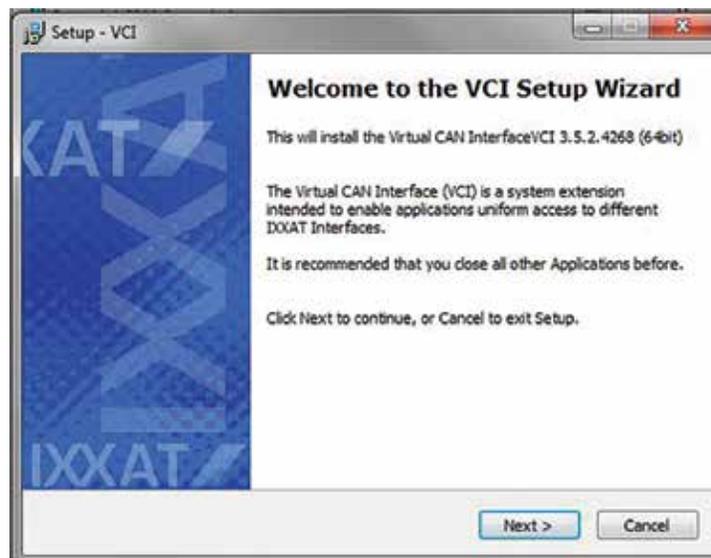
Fig 2   VCI Setup Wizard

Setting Up Hardware

The ICM Commissioner is designed to work with all of IXXAT's CAN adapters (purchased separately from manufacturer). When the Commissioner opens, it will automatically search for one of these adapters. Connect the adapter before opening the Commissioner to accelerate the process of getting the Commissioner started and connected. The description and wiring diagram illustrating how to connect a USB-to-CAN v2 adapter can be found in **Appendix A**.

Note: The Commissioner will not be able to communicate with the target ICM if the hardware is not connected properly.

Power must be provided to the ICM. Any power supply capable of providing between 9.5 and 12 V (dc), and at minimum 250 mA can be used. 250 mA is the minimum supply current to operate the ICM with several pilot valves actuated; operating the ICM with additional sensors may require more available current. The wiring diagram shown in **Appendix A** has provisions for connecting power to the ICM.

NOTICE: Operating outside these parameters can result in damage to the ICM product.

NOTICE: The ICM should be disconnected from any additional CANopen devices during any operations with the ICM Commissioner. The Commissioner is designed to communicate with only one device at a time, and could cause erroneous behavior if used with multiple devices.

ICM Information Tab

When opening the Commissioner, the ICM Information tab shown in Fig 3 will be displayed.
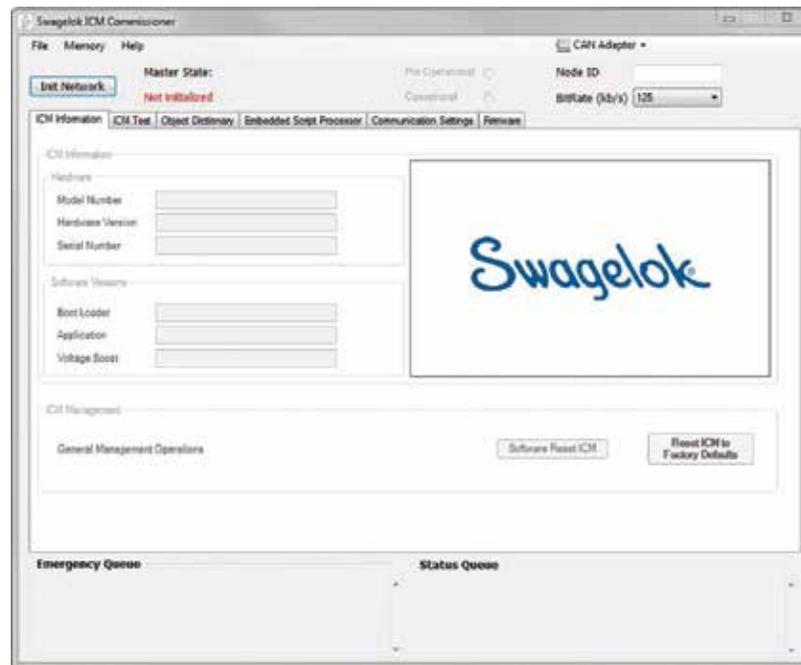
Fig 3   ICM Information Tab

At this point the Commissioner has not connected to either the CAN adapter or the ICM. To establish that connection, press the "Init Network" button in the upper left corner of the screen. That will bring up a menu which will allow the user to select which CAN adapter the user would like to use. In the example shown in Fig 4 there is only one option, but the Commissioner will list all of the recognized CAN adapters present in the system.

Note: The Commissioner cannot determine the bit rate of the target ICM. The default bit rate is 125 kb/s. If the ICM has been set to a different rate for any reason, the "BitRate (kb/s)" field in the upper right corner of the ICM Information Tab will need to be manually updated to the target's actual bit rate.

Note: The Commissioner will attempt to determine the node ID of the connected ICM when the "Node ID" field is blank. Leaving the "Node ID" field blank is recommended if you are unsure of the ICM's node ID. If a node ID is entered in the field, the Commissioner will only attempt to establish communications with an ICM at that node ID.

Selecting "OK" on the Select CAN Board screen (Fig. 4) will start the initialization sequence, which takes several seconds to setup communications and scan the CAN bus for attached devices.
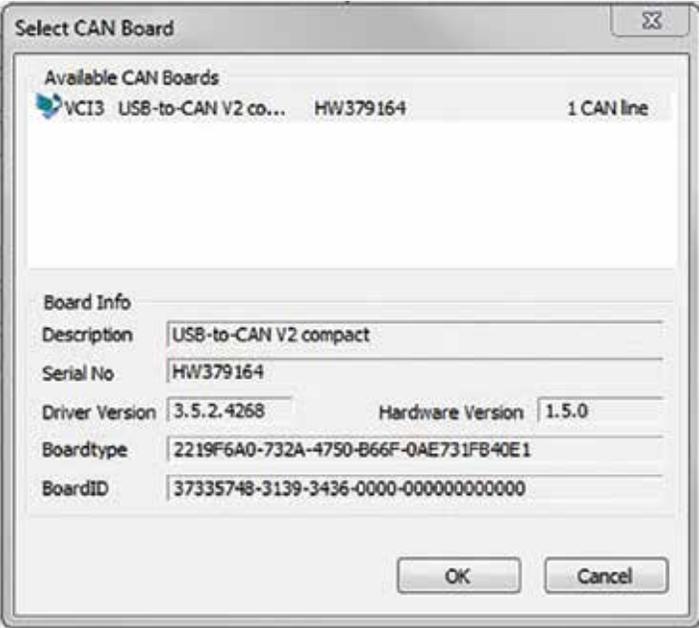
Fig 4   Select CAN Board

At the end of this period, the Commissioner will be connected to the ICM, and the "ICM Information" tab should look like Fig 5. By default, this menu will open every time the user connects to the ICM through the CAN adapter. If desired, it can be skipped by selecting the "CAN Adapter" tool icon in the upper right corner of the menu bar, and uncheck the "Always Select" item.
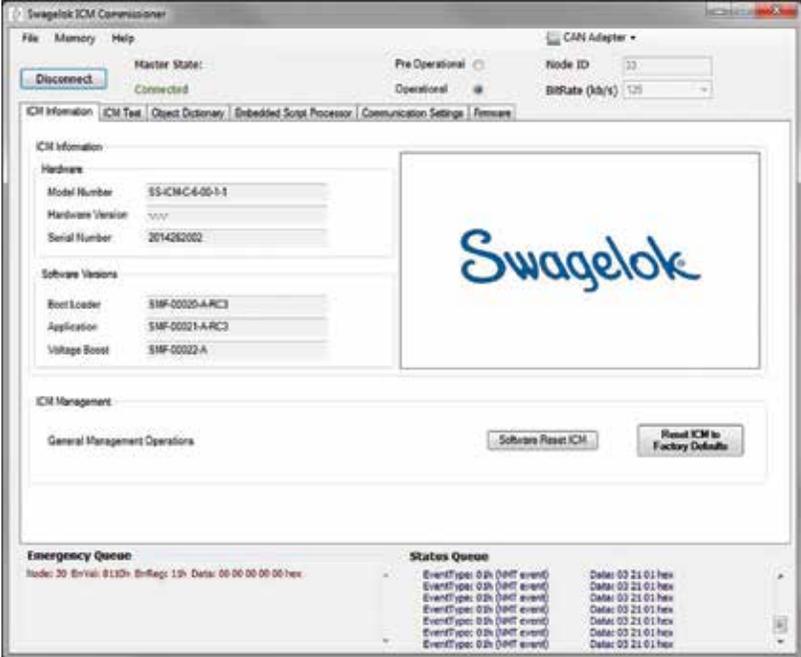
Fig 5   Information Tab Populated

This screen can be used to perform two actions in addition to retrieving some manufacturer's data (Model, Versions, and Serial Numbers): "Software Reset ICM" and "Reset ICM to Factory Defaults".

■   "Software Reset ICM" performs the same function as cycling power to the device but can be performed over the CAN connection. Any settings or scripts which had been loaded to the device but not saved to non-volatile memory will be erased.

■   "Resetting the ICM to Factory Defaults" restores all settings to the factory default. All changes to the ICM's settings, Object Dictionary, and Embedded Script Processor will be deleted and the Object Dictionary setting will be in the state indicated in the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228.

ICM Test Tab

The ICM Test tab provides an interface to the inputs and outputs of the ICM. Each of the control sections are described below. The interface to the ICM through the ICM Test tab is not instantaneous. The user can expect a delay of several seconds between the activation of a command and a response on the ICM. This is not a reflection of the ICM's response time on a CAN bus, but rather a characteristic of the Commissioner.

Sections within the ICM test tab are described here.

Control Mode

The Control Mode allows the user to select whether the Valve States can be controlled individually, or activated automatically in an incremental fashion. The "Switches Active" radio button, when active, allows the user to manually set the state of each valve under the Valve States control. When the "Auto Increment" radio button is active, the valves will incrementally activate automatically until the user selects the Switches Active button, deactivating the Auto Increment function.
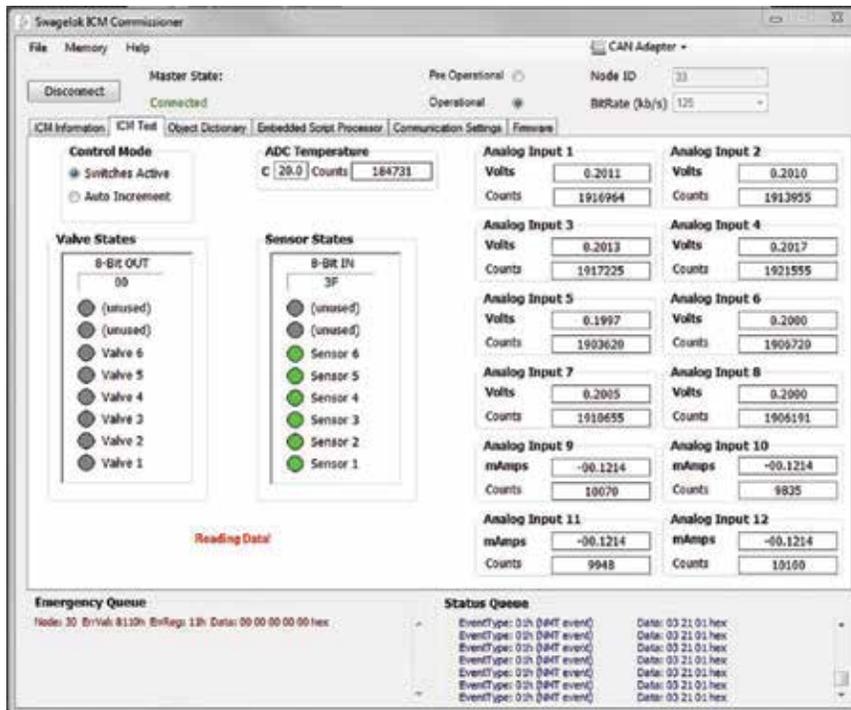
Fig 6   ICM Test Tab

Valve States

As described in the Control Mode section, this control either displays the state of each ICM pilot valve (if the Control Mode is set to Auto Increment) or allows the user to set the state of each valve (if the Control Mode is set to Switches Active).

In the "Switches Active" Control Mode, the user can click on any of the circles next to each valve label and activate or deactivate the pilot valve in question. Active pilot valves will have a green circle; inactive valves will have a grey circle.

ADC Temperature

The ADC Temperature readings provide the user with both the calculated temperature and the raw measured value. No field in this control can be edited by the user.

Sensor States

The state of each digital input is displayed here. The indicators will display either green or grey, depending on the state of the digital input bit:

Indicator Display	State of Digital Input
green	logic high or nothing attached to input
grey	logic low or inactive sensor port with no sensor attached

Sensor ports can be activated and inactivated via the Object Dictionary.

Analog Inputs

Analog Inputs 1 through 12 show the measurements taken from the ICM analog inputs. Each Analog Input has two fields, a calculated value field (either Volts or milliAmps) and a field with the raw analog-to-digital converter counts value. These fields are read only; the user cannot edit these fields. The Counts field can be used to calibrate the ICM's analog inputs per the instructions found in the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228.

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Object Dictionary Tab

The Object Dictionary tab allows users to change settings in the ICM. Objects are defined in Appendix A of the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228. Sections within the Object Dictionary tab are described here.
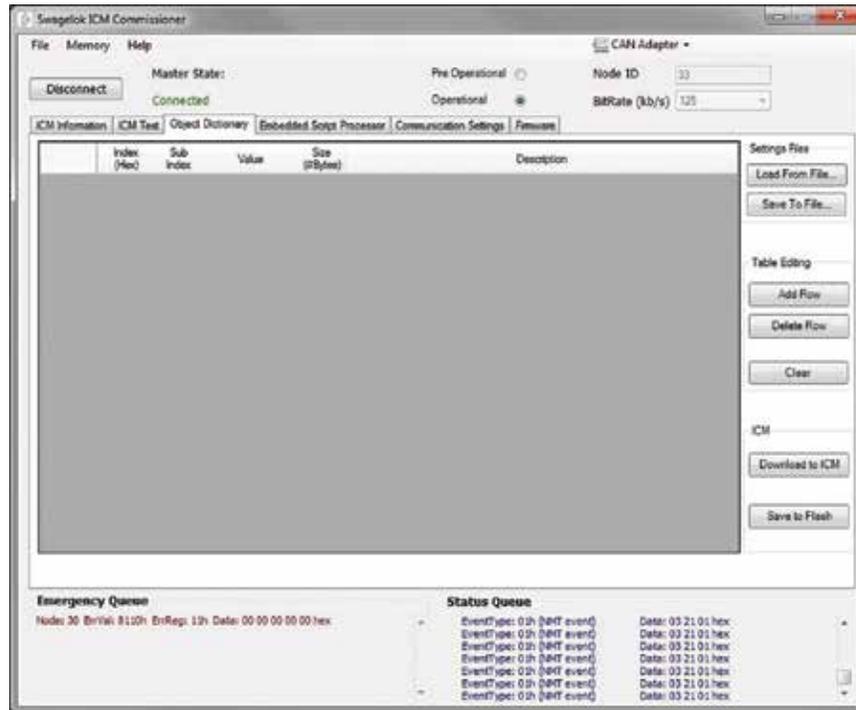
Fig 7   Object Dictionary Tab

Load From File

Pressing "Load From File" opens a standard open file dialog, which allows the user to browse for a comma separated value (.csv) file with the Objects stored within the file.

Save To File

"Save To File" opens a standard save file dialog, which allows the user to save the file to any location preferred.

> **Note:** The settings files are .csv files, which means any additional commas entered will cause the file to be read incorrectly. For that reason, saving object dictionary entries with commas in them will cause an error and the file will not be saved. Editing the settings file in an external program can cause errors if extra commas are added. However, the errors will be limited to the rows containing the extra commas.

Add Row

Pressing "Add Row" adds a row below the active row. The user then can populate the fields in the new row in the following manner:

Index (Hex): All Objects have an index. These are detailed in Appendix A of the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228. For example, the index, in hexadecimal, for the Analog Input Interrupt Trigger Selection object, which allows the user to choose which type of alarm to set for any given analog input channel, is 6421h.

Sub Index: Some objects have Sub Indexes as well as an Index. These are also detailed in Appendix A of the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228. To continue the example, to set which type of alarm to use on Analog Input #1, select Sub Index 01h.

Value: Each Object will have a value that can either be written, read or both. In the example, the value of the Analog Input Interrupt Trigger Selection for Analog Input #1 is a one-byte number, where each of the lowest five bits activates an interrupt for a different type of alarm. If, for example, the user wants to set an interrupt to occur when the input became too high, the binary value would be 00000001b, or in hex, 01h. Alternately, if the user wants to have interrupts for both the input value exceeding a certain value, and for the value increasing faster than a certain rate, the binary value entered would be 00010001b, or 11h in hex. A single click on "Value" in the header row will toggle between decimal and hexadecimal display.

Size (#Bytes): The size for the value of any given Object should be entered here. These values are available in the Object Dictionary table in Appendix A of the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228.

Description: The user can put any comments here, but should avoid using commas, as that will cause the .csv file to be read incorrectly.

Delete Row

The "Delete Row" button will permanently remove the active row (the row with the black arrow on the far left side).

Clear

The "Clear" button will delete all rows in the Object Dictionary field.

Download to ICM

This button will download all rows in the Object Dictionary table to the ICM. At this point the changes made to the Objects are in volatile memory. The ICM will behave as indicated by the Object Dictionary table, but the changes have not been saved to permanent memory inside the ICM. This means that the previous settings are still loaded in the permanent Flash memory and the new setting would be lost if there were a power cycle or Reset command sent.

Save to Flash

This button will command the ICM to load the Object Dictionary in volatile memory (through the use of the "Download to ICM" button) to its permanent Flash memory. At this point, previously loaded Objects will be overwritten by the new values and all changes will continue to be available after a power cycle. The saving of the Object Dictionary to Flash memory does NOT save the calibration constants or the user script to Flash memory.

Embedded Script Processor Tab

The Embedded Script Processor tab provides an interface for the user to create and download user-generated programs to customize the operation of the ICM for specific applications. Refer to the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228, for additional information on generating user scripts.
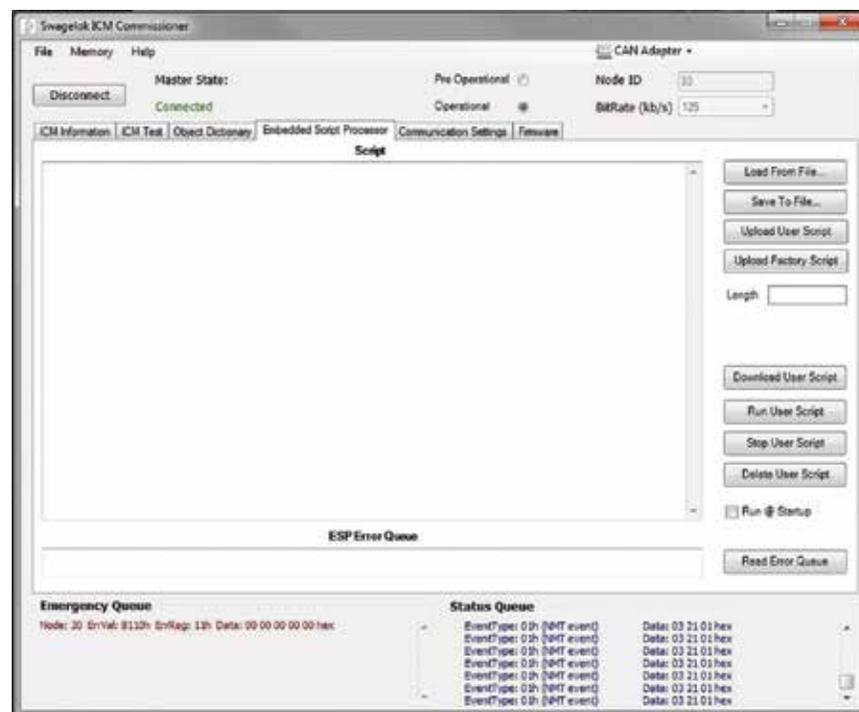
Fig 8   Embedded Script Processor Tab

Load From File

This button will open a standard dialog to allow the user to browse for an existing script.

Save To File

This button opens a standard dialog to allow the user to set the name and storage location of the current script.

Upload User Script

This button uploads the ICM's current user script to the Commissioner. It does not delete the script on the ICM.

Upload Factory Script

This button uploads the factory script from the ICM. The factory script is not deleted from the ICM during this process.

Length

This field displays the current length of the user script in number of characters.

Download User Script

This button loads the current script from the Commissioner to the ICM and saves it in non-volatile memory.

Run User Script

This button causes the user script currently loaded in the ICM to run.

Stop User Script

This button causes the currently loaded user script to stop running.

> **Note:** It is possible for user scripts to send commands to the ICM faster than it can process them. When this happens, the ICM queues the commands and handles them as quickly as possible. If the user stops a user script that has sent enough commands to the ICM that they have already queued up, the script will stop sending additional commands. However, the commands already sent will continue to be processed by the ICM until the queue has been exhausted.

Delete User Script

This button deletes the user script from the ICM.

Run @ Startup

Checking the Run @ Startup box will set the ICM to run the loaded user script when it finishes its start-up process.

   Note: By default this option is unchecked. Verify proper operation of all scripts prior to using this command.

This option is only saved to the ICM when the user hits the "Download User Script" button.

Read Error Queue

As the ICM interprets and runs scripts, it may encounter syntax or run-time errors. As errors are detected, the ICM writes ASCII error messages to a buffer referred to as the Error Queue (stderr). This button reads messages from the ICM Error Queue and displays them.

Each error message is formatted as follows:

<prefix>:<line number>:<description>,<free memory>

Some example error messages are below:

[string "ESP"]:65:ESP:Script stopped,free mem=8029128

[string "ESP"]:91:')'expected near 'local',free mem=8029048

[string "ESP"]:2:attempt to perform arithmetic on global 'c' (a nil value), free mem=8040480

[string "ESP"]:90:'}' expected (to close '{' at line 85) near 'function', free mem=8029032

[string "ESP"]:3:attempt to perform arithmetic on global 'b' (a string value), free mem=8040432

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Communication Settings Tab

The Communication Settings tab allows the user to set the two variables which affect the ICM's ability to communicate over the CAN bus: the Node-ID and Bit Rate.
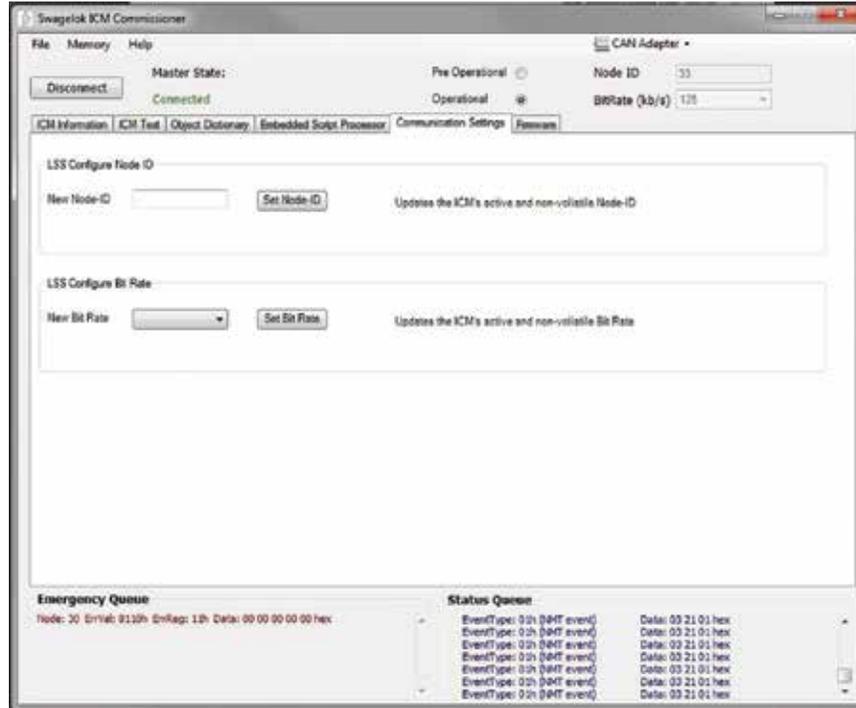
Fig 9   Communications Settings Tab

Node-ID

The Node ID field accepts any value between 1 and 127. Clicking the associated Set Node-ID button will set the ICM to the entered Node-ID. The Node ID field in the upper right-hand corner of the Commissioner will also be updated to show the new ID.

Bit Rate

The Bit Rate field allows the user to select the speed at which the ICM will communicate from a drop-down menu of allowable values. Clicking the Set Bit Rate button will set the ICM to the new rate, and then reset the ICM. The user will have to reconnect to the CAN adapter after this reset is complete. The Bit Rate field in the upper right hand corner of the Commissioner will also be updated to show the new bit rate.

> **Note:** The appropriate Bit Rate is dependent upon the network that the ICM will be set up in. Factors such as Hazardous Locations barriers, length, and topology have to be considered, as well. However, it is useful in a setup or laboratory setting to configure the ICM to a higher Bit Rate to speed up downloads, such as when updating firmware.

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Firmware Tab

The Firmware tab allows the user to update the operating firmware of the ICM.

NOTICE: Use the firmware files available through www.swagelok.com only. Files obtained from a third party could cause permanent device failure if loaded onto the ICM.
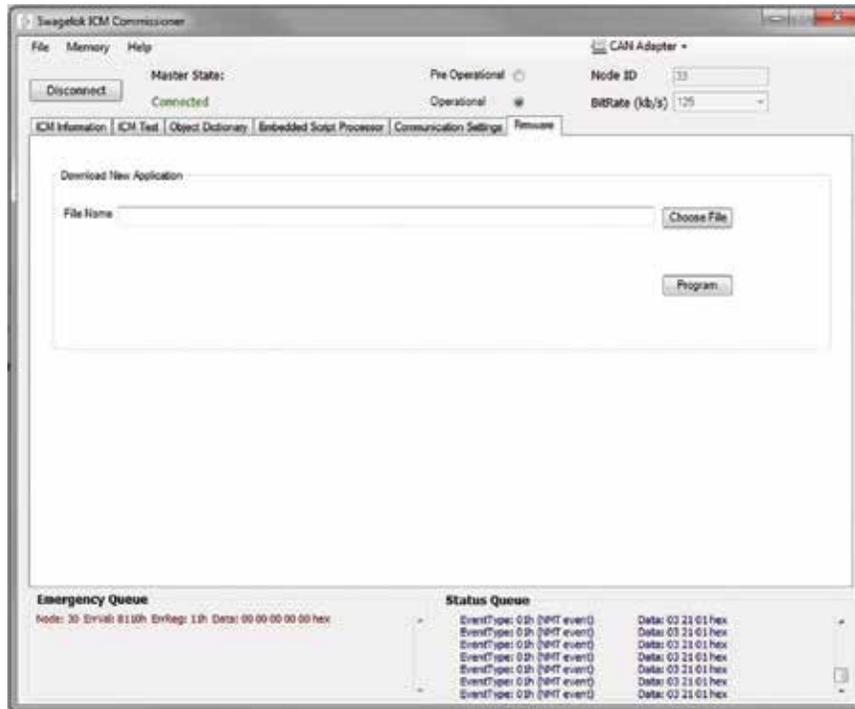
Fig 10   Firmware Tab

Choose File

The Choose File button opens a standard dialog that allows the user to select the firmware file (*.hex*) to be downloaded. This file will only come from Swagelok and would not have been created by a user or other third party.

Program

This button initiates the firmware installation process. After "Program" is clicked the following message will appear: "Programming Now- Will take approximately ten minutes to complete" The actual programming time will depend on the size of the application file and the Bit Rate selected.

Memory

Selecting the Memory menu from the menu bar at the top of the screen will bring up a warning that the user is about to access the ICM's calibration constants as shown in Fig 11.
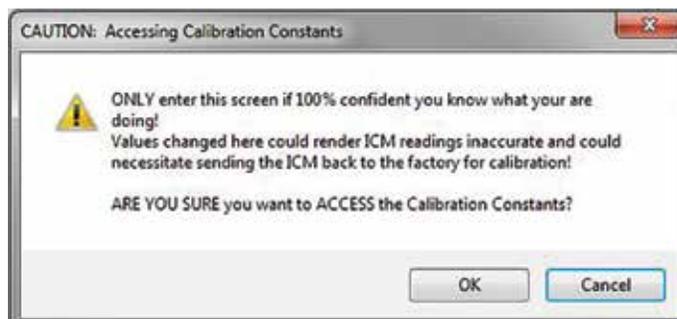
Fig 11   Calibration Constants Warning

Note: Improperly altered calibration coefficients cannot be corrected without contacting Factory Technical Support.

Note: The "Restore ICM to Factory Defaults" button on the ICM Information tab will not return the calibration constants to the values that they held when the ICM left the factory. This is to protect the coefficients loaded as part of the factory calibration. Only the gain and offset coefficients will return to their default values.

When the user selects OK, the Calibration Constants table will be brought up as shown in Fig 12. These are the values used to convert the raw ADC counts measured by the analog input channels into the measured voltages, for channels one through eight, and current, for channels nine through twelve.

Calibration Constants
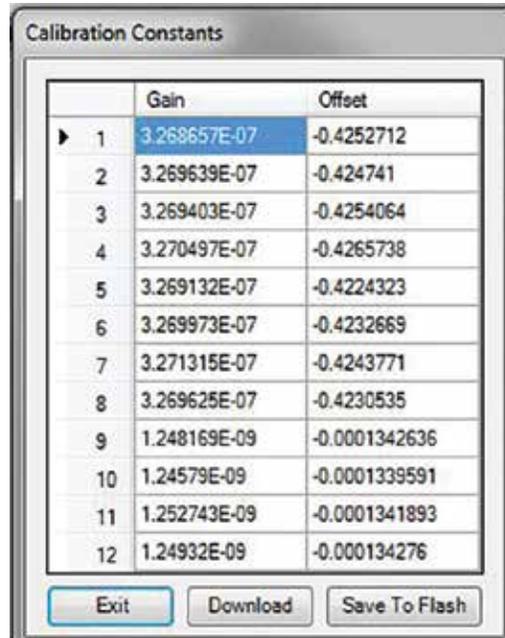
	Gain	Offset
1	3.268657E-07	-0.4252712
2	3.269639E-07	-0.424741
3	3.269403E-07	-0.4254064
4	3.270497E-07	-0.4265738
5	3.269132E-07	-0.4224323
6	3.269973E-07	-0.4232669
7	3.271315E-07	-0.4243771
8	3.269625E-07	-0.4230535
9	1.248169E-09	-0.0001342636
10	1.24579E-09	-0.0001339591
11	1.252743E-09	-0.0001341893
12	1.24932E-09	-0.000134276

Exit   Download   Save To Flash

Fig 12   Calibration Constants Table

Selecting any cell in the table enables the user to place a new constant in that cell. If desired, the values can be selected (click left mouse button and drag across needed cells, as one would in a spreadsheet), copied, and then pasted to a separate document. This function allows the user to calibrate the ICM's analog inputs at the calibration vendor of their choosing.

Refer to the *Intrinsically Safe Intelligent Control Module™ (ICM™) Product Programming Reference Manual*, MS-13-228, for more information on calibrating the ICM.

Exit

Selecting this button will close the calibration coefficient interface without making any changes to the stored values.

Download

Selecting this button will load the coefficients into active memory. Using this button will allow the user to see the effects of the changes, but will not save them to non-volatile memory.

Save to Flash

Selecting this button will save the entered data into non-volatile memory.

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Appendix A — ICM Cable Options

As mentioned in the **Setup Hardware** section, power for the ICM is not provided by the USB-to-CAN v2 module so provisions must be made to connect an external power supply to the ICM. An appropriate power supply will be able to source between 9.0 and 12.0 V, and at minimum 250 mAmps (additional sensors connected to the ICM, whether they are transducers connected via one of the four general purpose I/O DB9 connectors, or one of the six digital inputs, will draw current above and beyond that value).

The simplest option to provide power to the ICM is to use a commercially available "Y" cable. Any commercially available male DB9 to two female DB9 splitter cable, with a straight through pin out is acceptable. Use the extra branch of the cable to connect power to the ICM. See Fig 13 for an example setup.
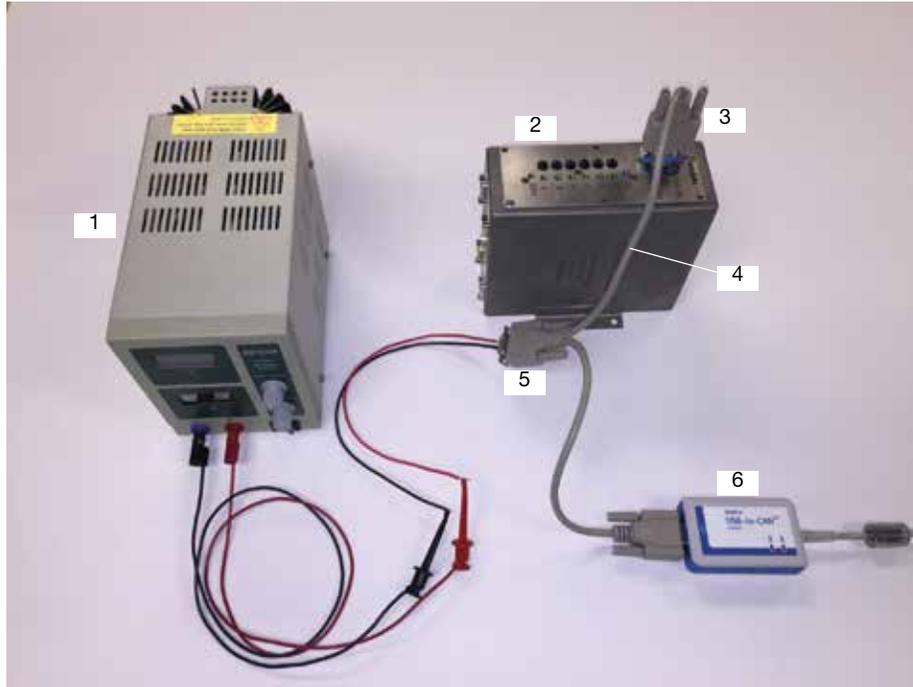
Fig 13   Power Cable Setup

The components used in this setup include:

1   DC Power Supply: any supply capable of sourcing 9.0 to 12.0 V dc and 250 mAmps (more required if additional sensors are attached)

2   Swagelok ICM (SS-ICM-C-6-00-1-1 in this example)

3   Sub-D9 Connector with CAN Termination (IXXAT component)

4   Sub-D9 Y Cable, male to female/female (IXXAT component)

5   Sub-D9 Connector Receptacle (Norcomp or Amphenol component)

6   IXXAT USB-to-CAN v2 module (the Compact version is pictured, but the Commissioner works with any of the modules in this series)

The lead wires attached to Part 5, Fig 13, are connected to the following pins:

• Pin 3: Ground
• Pin 9: Power

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Alternatively, if the user wishes to assemble a custom cable, the following wiring guide can be used.
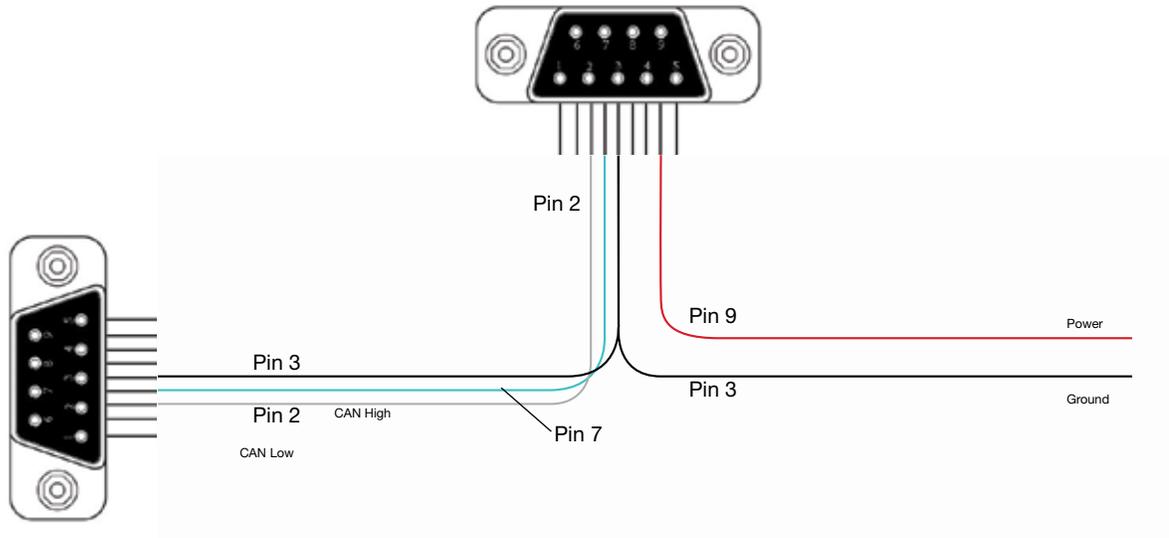
Fig 14   Alternative Power Cable Setup

Signal	ICM Connector	CAN Adapter Connector	Lead Color
Power	pin 9	no connection	red
Ground	pin 3	pin 3	black
CAN High	pin 7	pin 7	no lead
CAN Low	pin 2	pin 2	no lead

Note: In either case, the terminating resistor (Part 3, Fig 13) must be used to ensure proper signal integrity.

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