REGULATEURS EUROPA
Member of the
Heinzmann Group

Instruction Manual

ICENI/MA-03

DeviceNet Master Module

Pub_3676 - Issue 1

INDEX

1 FOREWORD

These instructions have been compiled to assist personnel responsible for the operation and maintenance of equipment manufactured by Regulateurs Europa Ltd.

Care has been taken to ensure that the equipment has been accurately represented, but it should be appreciated that, with the continued progress of design and the diversity of application, certain items may differ in detail.

It should be noted that these instructions are issued for general information and do not constitute a specification of the equipment.

Whilst reserving the right to make any alteration in design which they may consider advisable the manufacturers absolve themselves from making any such alteration retrospective.

In addition to the information given herein, practical advice and assistance is always available from the Customer Support Department at Regulateurs Europa Ltd.

2 GENERAL USE

Before carrying out any repairs, adjustments or maintenance to any equipment supplied by Regulateurs Europa Ltd, it is essential the following safety precautions be observed.

2.1 General

The operator should take care to make themselves thoroughly familiar with the operating principles, methods of adjustment and the dismantling and assembly procedures (where applicable) concerning the equipment in use.

2.2 Product Condition

Before power-up ensure that the product is in a good condition and not damaged, paying particular attention to the ICENIbus connectors on each side of the module and the field wiring connectors at the top of the module. Ensure that any wires are fitted securely into terminals.

2.3 Signal Connection

If the module requires configuration then ensure that any critical signals are disconnected from the module until configuration of the module has been performed. This will prevent unwanted or unexpected changes in signal polarity from affecting other circuitry.

2.4 Module Damage / Repair

The Iceni modules are not repairable. Where damage is found that could compromise the operation of the module, a replacement part should be sourced from Regulateurs Europa Ltd.

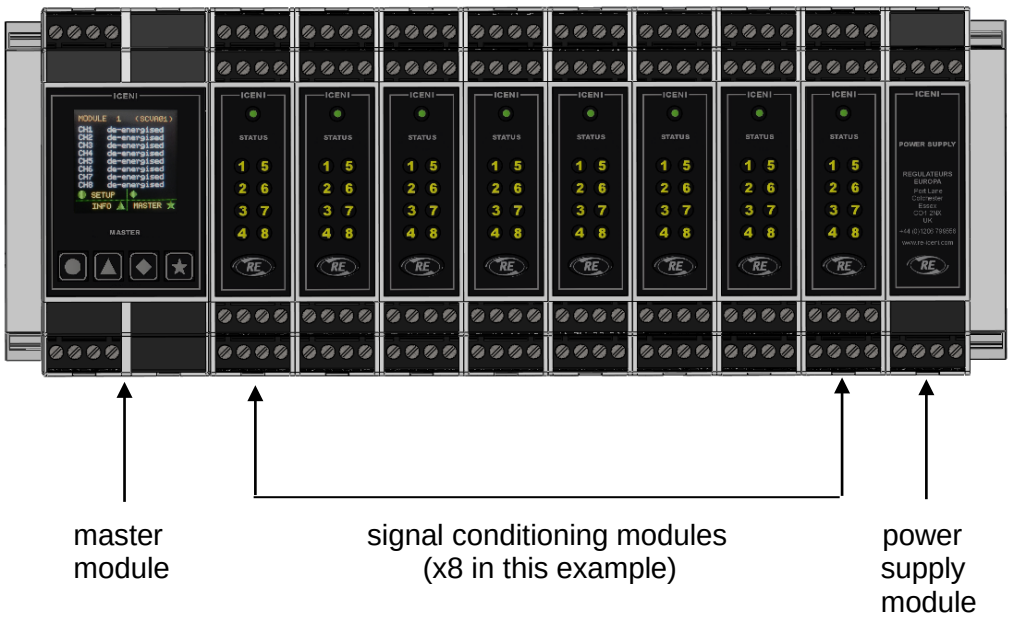
Iceni module should be disposed via an approved disposal scheme suited to electronic products and in accordance with local legislation.

3 PRODUCT OVERVIEW

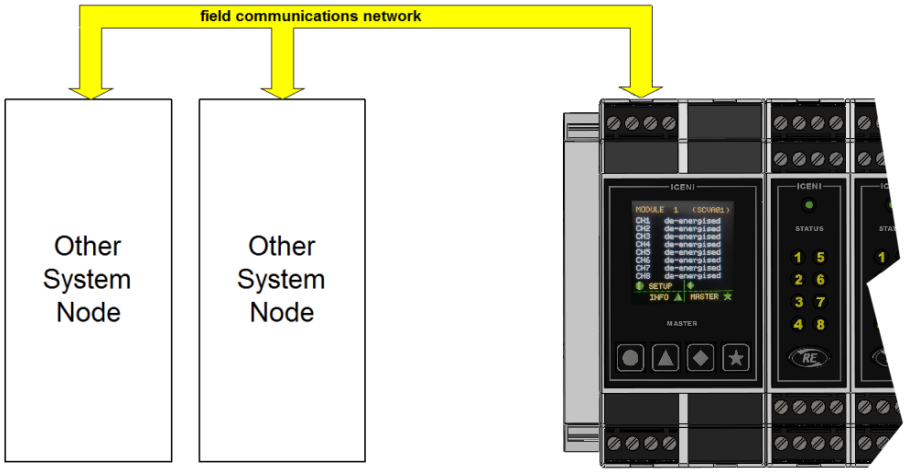
3.1 Iceni Node

An Iceni node comprises of a master module, between one and sixteen signal conditioning modules and at least one power supply module.

A typical Iceni node:

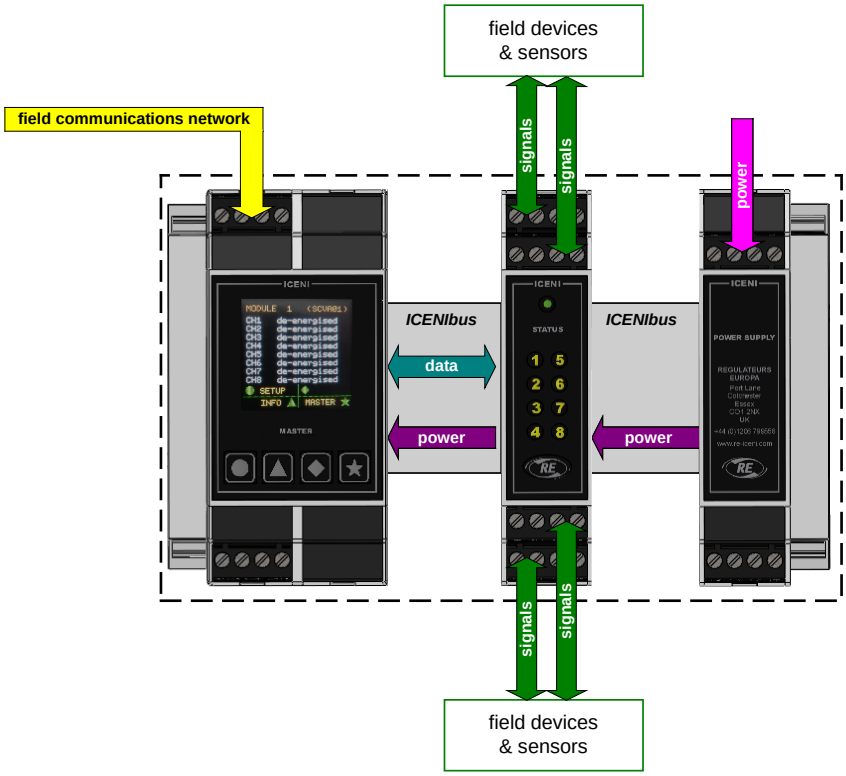


According to the mix of signal conditioning modules, the Iceni node manages the measurement and generation of electrical signals to/from sensors and field devices. Information is exchanged with other nodes in a system via a field communications network connected to the Iceni master module.

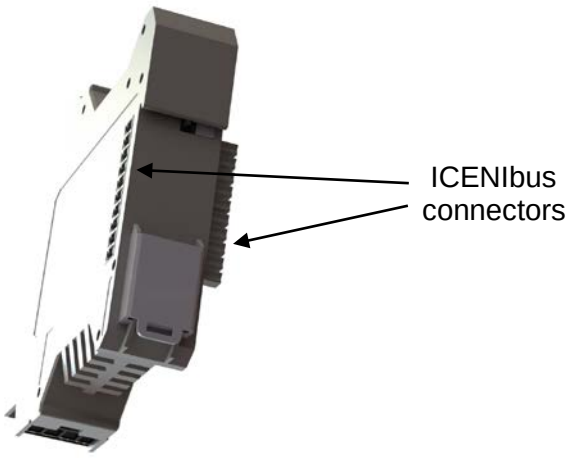


3.2 ICENIbus Interface

Iceni modules are designed to plug together to form a node. The connection system used to join one module to another is called ICENIbus and is used to transfer both data and power supply between modules.



All modules have a 10-way ICENIbus connector on both sides of the lower housing, although for end modules (master and main power supply) one side connector will be supplied fitted with a protective cover.



3.3 Field Wiring Interface

As standard, Iceni modules are supplied with screw-clamp field wiring connectors, although cage-clamp variants are available as an option.

For ICENI/MA-03 there are two connectors marked 1-4 and 13-16 to match the numbers marked on the Iceni housing. This arrangement identifies the connector to its location on the module.

When fitted properly, the field wiring connectors are held securely in the module housing. In order to remove a terminal, a small flat bladed screwdriver should be inserted between the top of the connector and the module housing to enable the connector to be carefully levered free. This will release the connector without damage.

4 ICENI/MA-03 KEY FEATURES

The ICENI/MA-03 module is a component of an Iceni node and provides a slave interface to a DeviceNet field communications network and coordinates data flow between Iceni modules within a node.

The ICENI/MA-03 module also provides an access point for configuration and status display via the in-built User Interface

The ICENI/MA-03 module provides the following key features:

- Data access to/from up to sixteen signal conditioning modules, each with a maximum of eight I/O channels.
- DeviceNet (slave) field communications interface for communication of data to a remote station.
- Node health status indication via changeover relay contacts.
- Colour graphic display and keypad for Iceni node and signal channel configuration and access to channel measured, driven and status information.
- Self-configuration of Iceni node at power up.

5 PRODUCT SPECIFICATION

5.1 Electrical Properties

5.1.1 Power Supply Input

Maximum ICENIbus consumption:	200mA

5.1.2 Field Communications Network

DeviceNet:	slave
Supported ODVA standards:	CIP Networks Library: Vol. 1, Ed. 3.11 CIP Networks Library: Vol. 3, Ed. 1.12
Baudrate:	125k, 250k, 500k
Network termination:	external to Iceni module

5.1.3 Fault Status Indication

Output type:	relay clean contact (changeover)
Fault sensing / indication:	failure of signal conditioning module/s failure of master module
Series resistance (on):	< 50mOhm
Switching current (maximum):	1A @ 24Vdc
Switching voltage (maximum):	125Vdc / 150Vac
Switching capacity (maximum):	30W / 60VA

5.1.4 Signal Isolation

DeviceNet interface to ICENIbus :	1kV
DeviceNet interface to fault status output:	1kV
Fault status output to ICENIbus:	1kV

5.1.5 Field Wiring Termination

2 x 4-way free part sockets with screw terminals. (Cage-clamp option available)

Wiring cross section / strip length	0.14 to 0.5mm^2 / 7mm

5.2 Mechanical Properties

5.2.1 Temperature Range

Operating:	-20°C to +70°C (-4°F to +158°°F)
Storage:	-40°C to +85°C (-40°F to +185°F)

5.2.2 Material

Enclosure:	Polyamide
Labels:	Polyester
Membrane overlay:	Polyester

5.2.3 Weight

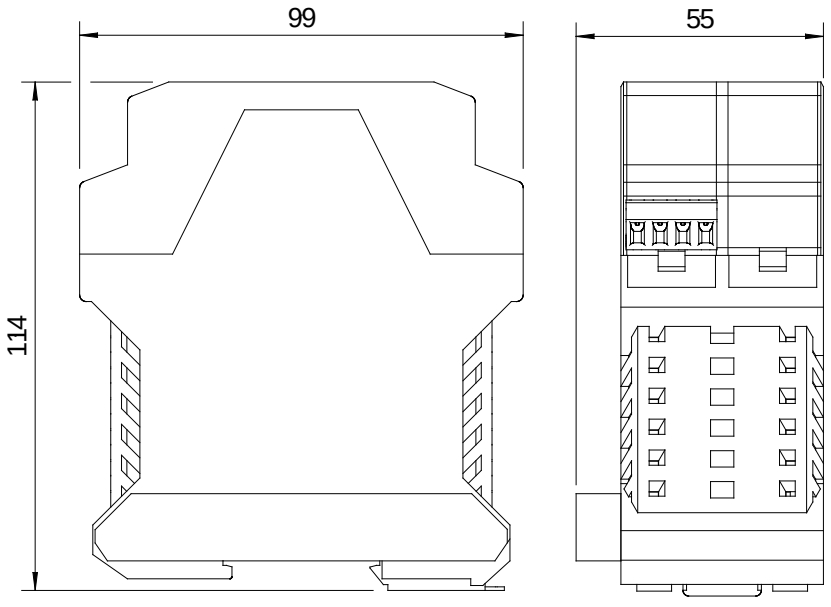
Module weight (including free part screw terminals):	170g (approx.)

5.2.4 Ingress Protection

Assembled node:	IP20

5.2.5 Dimensions

(Dimensions shown in mm)



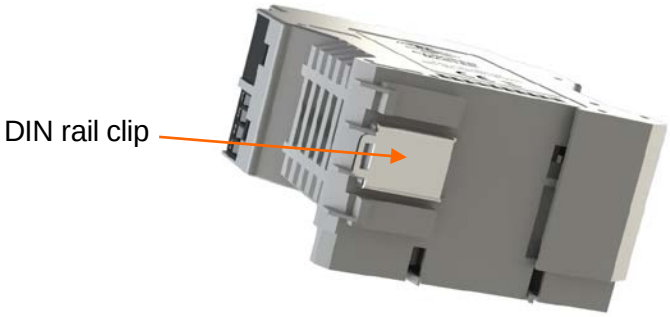
6 UNPACKING & INITIAL PREPARATION FOR USE

6.1 Unpacking

The module should be removed from the sealed bag inside the protective cardboard carton. All packaging should be disposed of in an appropriate way.

6.2 Node Assembly

The module is designed to clip and fit onto TS 35 DIN terminal rail (both standard and deep types) with other Iceni modules to form a node. A metal clip is provided on the base of each module for this purpose.



An Iceni node can be mounted in both vertical and horizontal orientations according to terminal rail layout. Assembly of the Iceni node can be achieved in one of two ways:

- The Iceni node (including the ICENI/MA-03 module) can be assembled on a bench and then fitted into place on the DIN rail with a slight tilting action. It is important that the metal DIN rail latch on the underside of each module engages properly with the rail to retain the modules in place.

- The ICENI/MA-03 module can be fitted with other modules one at a time on the DIN rail with a slight tilting action. It is important that the metal DIN rail latch on the underside of each module engages properly with the rail to retain the module in place. The modules can then be pressed together tightly to ensure that each module plugs into its neighbour to form the node.

6.3 Node Disassembly

Disassembly of the Iceni node is essentially the reverse of the procedure above and can be achieved in one of two ways:

- Each module can be separated from the next on the rail. The metal DIN rail latch can then be operated with a small screwdriver and the modules removed with a tilting action, one by one.

- The metal DIN rail latches for all modules can be released in turn with a small screwdriver until the Iceni node is free to be removed with a tilting action. The modules can then be separated from each other.

6.4 Module Positioning Within a Node

The ICENI/MA-03 module should be fitted in the yellow location shown in the diagram below.

7 FIELD WIRING TERMINATION

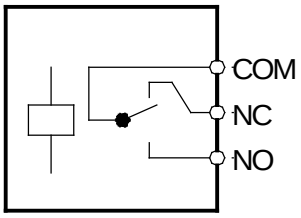
7.1 Terminal & Connector Layout

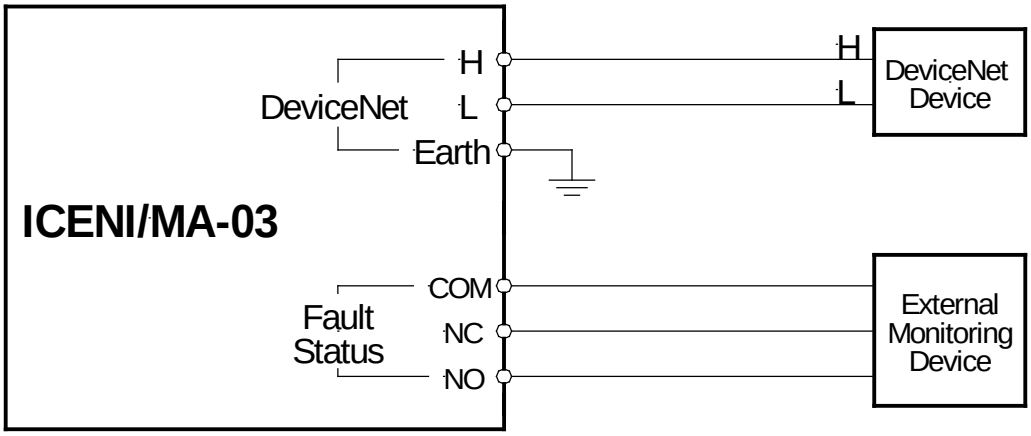
CHANNEL	TERMINAL	DESCRIPTION
DeviceNet Network	1	H
	2	L
	3	-
	4	earth

NAME	TERMINAL	DESCRIPTION
Fault Status	13	common
	14	normally closed contact
	15	normally open contact
	16	-

(- : not connected)

7.2 Wiring Schematic





7.3 Earthing / Grounding

The metal terminal rail to which the Iceni node is attached and the 'Earth' terminal should be connected to a 'clean' earth / ground point. In many applications this would be the chassis of the product.

It is recommended that screened DeviceNet network cables are used, with the screen connected to a 'clean' earth / ground point at the Iceni node end only. This might be via the terminal rail, for example.

7.4 DeviceNet Network Termination

If the Iceni node is at one end of a DeviceNet network, a 120R termination resistor should be fitted directly across the DeviceNet H and L terminals at the ICENI/MA-03 module.

8 MODULE OPERATION

8.1 Module Configuration

When the ICENI/MA-03 module receives power via the ICENIbus connector, it will automatically power up and commence an Iceni node configuration process.

8.2 Iceni Node Configuration

The ICENI/MA-03 will self configure the Iceni node.

During this process the master module will communicate with all signal conditioning modules fitted in the Iceni node to establish not only what modules are fitted, but where they are fitted in relation to the master and each other.

As the ICENI/MA-03 locates each signal conditioning module it allocates a unique module number to it. Each signal conditioning module will receive a module number between one and sixteen according to its position within the node (shown below):

The sequence of module numbers will be continuous i.e. if four modules are fitted then they will always take the module numbers 1, 2, 3, and 4, etc.

A healthy node will have at least one signal conditioning module fitted.

At the end of the Iceni node configuration process, the ICENI/MA-03 will show a sequence of numbers on the display representing the signal conditioning modules detected in the Iceni node.

8.3 Iceni Node Fault Status Output

The fault status output will de-energise (unhealthy condition) under any of the following conditions:

- Power loss to Iceni node
- Node configuration in progress
- Failure of any Iceni signal conditioning module
- A CANbus off error is initiated
- A communication timeout error is detected after I/O connection is established
- A duplicated MAC ID error is initiated

o

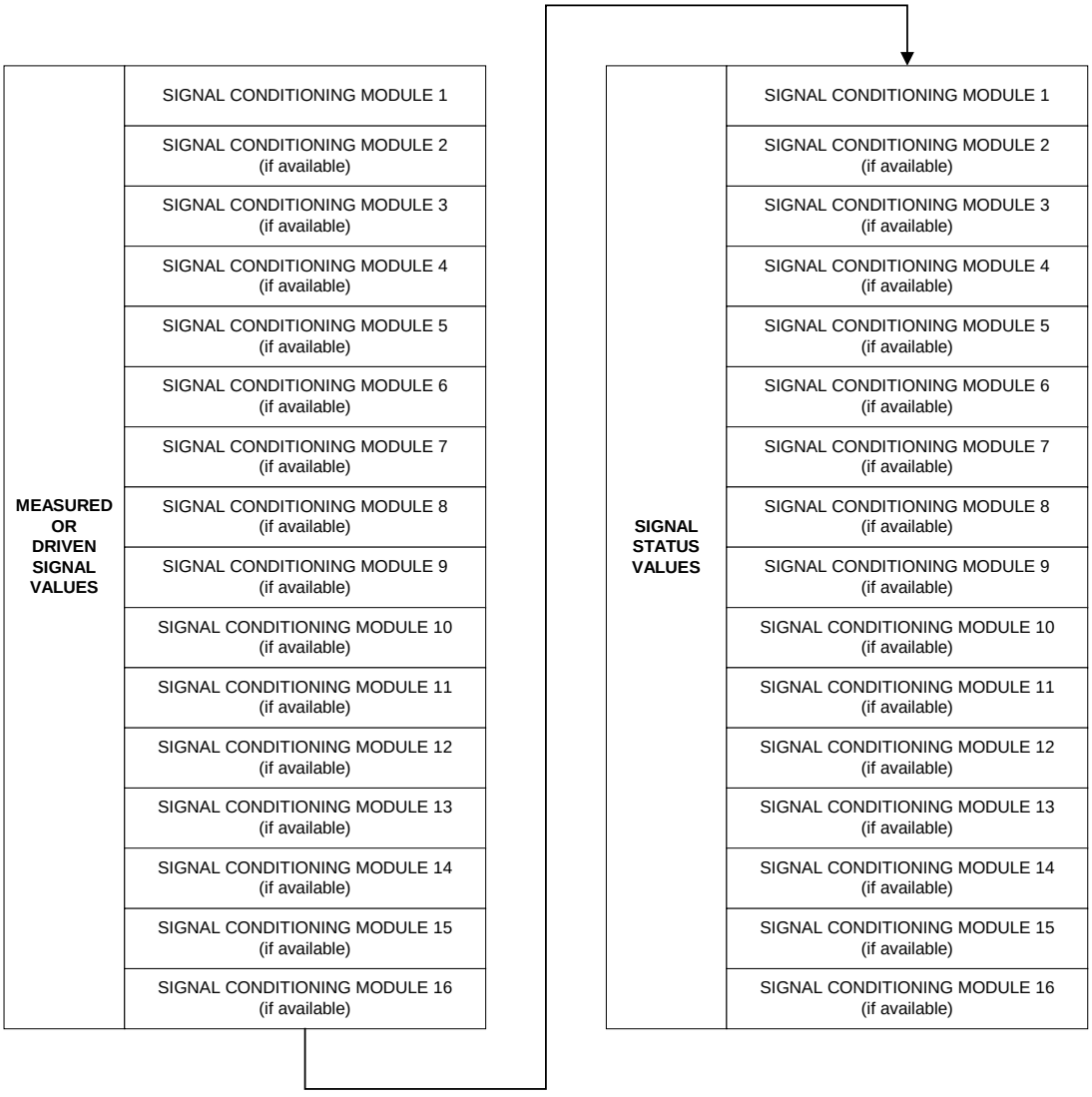
9 DATA COMMUNICATIONS TO SIGNAL CONDITIONING MODULES

9.1 Process Image

9.1.1 Node Process Image

The ICENI/MA-03 module communicates node data to field equipment via the DeviceNet field communication network. The DeviceNet protocol within the ICENI/MA-03 exchanges data with signal conditioning modules via a node process image.

The diagram below shows how the node process image is constructed.



9.1.2 Signal Conditioning Module Process Image

Following configuration of the Iceni node, the ICENI/MA-03 communicates with each signal conditioning module via the ICENIbus to transfer data to / from the field communications network. The data is exchanged between ICENI/MA-03 and signal conditioning module via a signal conditioning module process image.

The diagram below shows how the signal conditioning module process image is constructed.

SIGNAL INPUT / OUTPUT VALUES	SIGNAL CHANNEL 1 (if available)
	SIGNAL CHANNEL 2 (if available)
	SIGNAL CHANNEL 3 (if available)
	SIGNAL CHANNEL 4 (if available)
	SIGNAL CHANNEL 5 (if available)
	SIGNAL CHANNEL 6 (if available)
	SIGNAL CHANNEL 7 (if available)
	SIGNAL CHANNEL 8 (if available)

SIGNAL STATUS VALUES	SIGNAL CHANNEL 1 (if available)
	SIGNAL CHANNEL 2 (if available)
	SIGNAL CHANNEL 3 (if available)
	SIGNAL CHANNEL 4 (if available)
	SIGNAL CHANNEL 5 (if available)
	SIGNAL CHANNEL 6 (if available)
	SIGNAL CHANNEL 7 (if available)
	SIGNAL CHANNEL 8 (if available)

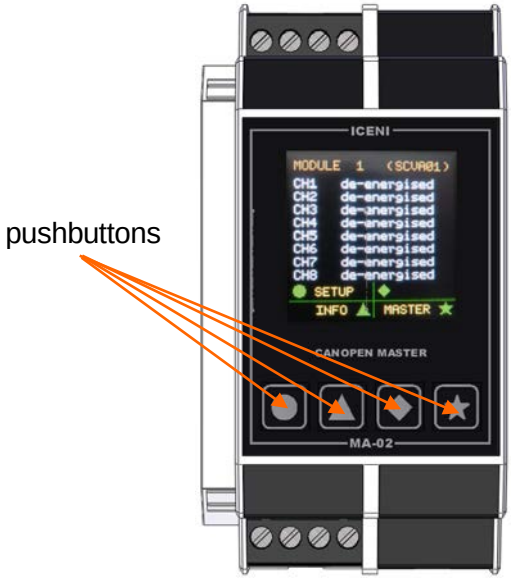
10 MODULE USER INTERFACE

10.1 Physical Interface

The ICENI/MA-03 provides a colour dot matrix display to allow status information to be viewed, and configuration of module parameters.

10.2 Keypad

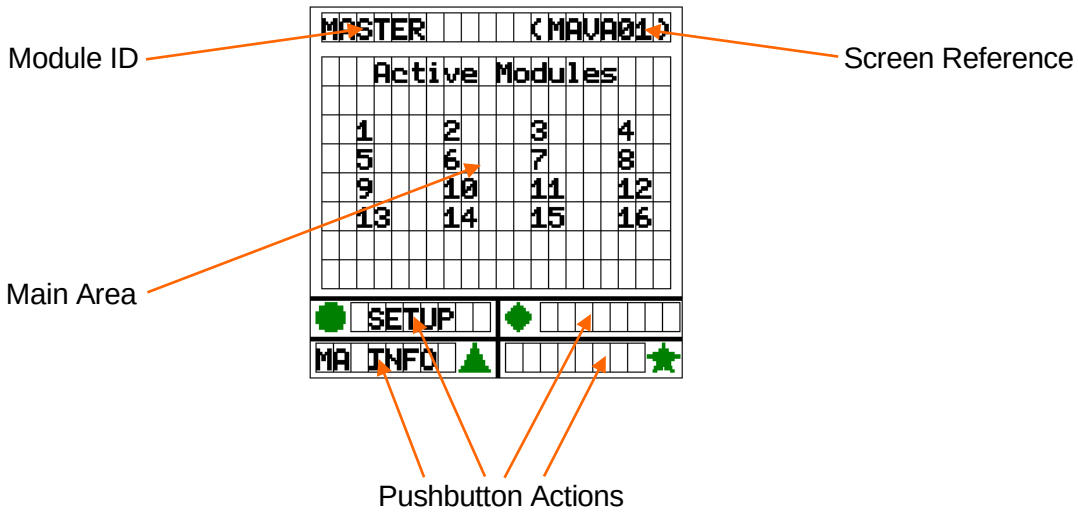
The ICENI/MA-03 also provides a four button keypad to allow display screen navigation and configuration of module parameters.



10.3 Display Screen Format

There are a number of different display screens presented to the user, but they share a common format described below.

(note – screen image not necessarily from ICENI/MA-03)



10.3.1 Module ID

This is the description of the module for which data is displayed on the display.

10.3.2 Screen Reference

Each screen layout has a unique reference shown in the top right hand corner.

10.3.3 Main Area

The central part of the screen is dedicated to status and parameter display. The screen layout in this area varies according to what is being presented.

10.3.4 Pushbutton Actions

The functions of the four pushbuttons dynamically change according to the screen layout presented on the display. The button action areas describe the function of each button should it be pressed.

10.4 Screensaver

Following initial power up, the ICENI/MA-03 has a built in screensaver function that is activated when no pushbutton activity has been sensed for five minutes. When this happens, the power to the display is automatically removed.

Any push button can be pressed to cancel the screen saver function and reset the screensaver inactivity timer back to zero. At this point power will be restored to the display.

10.5 User Interface Navigation

The four push buttons are used to navigate around the user interface. Each screen layout describes the action of each of the four push buttons and it is by following these actions that the user interface is navigated.

In addition to the four push buttons on the ICENI/MA-03, each signal conditioning module presents its own pushbutton on the top of its module enclosure. Pressing the button on a signal conditioning module provides a shortcut to the display of that module's signal values / status. However, the shortcut button is only active if the user is not already in the process of configuring parameters.

10.6 Changing the Configuration of Parameters

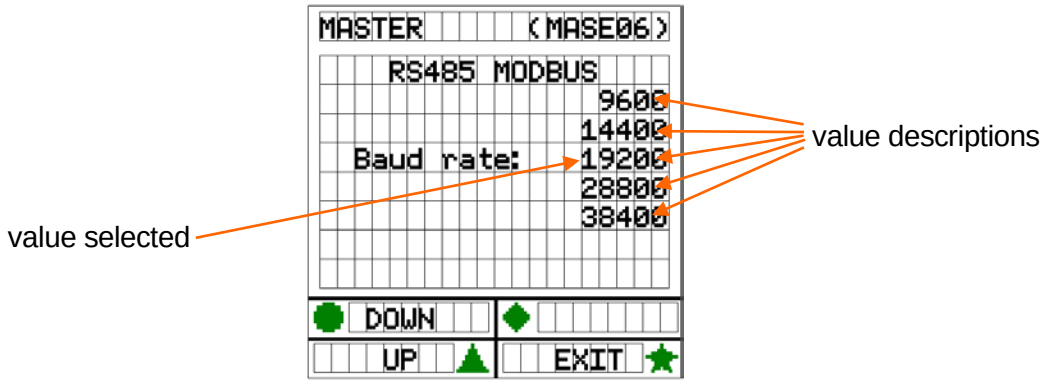
Using the four pushbuttons it is possible to change the value of certain parameters as part of the configuration progress.

Typically there are two types of edit function associated with parameters:-
- o Selection from a list
- o Numerical edit

10.6.1 Selection From a List

This method of editing is used when a parameter value is selected from a list of value descriptions, or when a continuous range of numerical values cannot be supported (e.g. 1 to 5 and 7 to 10, but not 6).

(note – screen image not necessarily from ICENI/MA-03)



The selected value description is the one in line with the 'Baud Rate' text and is highlighted the same colour. All other value options are highlighted in yellow.

The 'down' and 'up' pushbuttons can be used to scroll through the list of value options.

The 'exit' pushbutton should be pressed to complete the list edit.

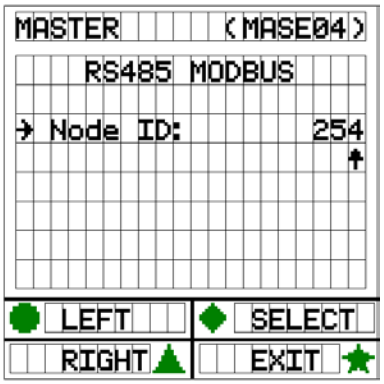
10.6.2 Numerical Edit

This method of editing is used where the value can be presented in numerical format and a continuous range of numerical values can be supported.

This method of editing is done in multiple stages - character position selection followed by numerical value change.

Character Position Selection

(note – screen image not necessarily from ICENI/MA-03)



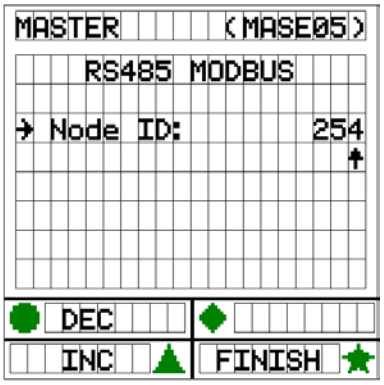
The numerical parameter will have a number of characters making up the value, i.e. if the maximum value held is 254 then there will be three characters for the parameter.

Using the 'left' or 'right' pushbuttons, the character to be changed can be selected. The character position is indicated by the selection cursor on the screen.

When the cursor is in the correct position, the 'select' pushbutton should be pressed.

Numerical Value Change

(note – screen image not necessarily from ICENI/MA-03)



Using the ‘dec’ or ‘inc’ pushbuttons, the character numerical value can be nudged down or up one increment where the increment is equal to the character position. i.e. if the selection cursor is in the ‘tens’ column then when ‘inc’ pushbutton is pressed, the value will be increased by 10.

The numerical value can be nudged up or down within the boundaries of the maximum and minimum values for the parameter.

When the correct value is chosen, the ‘finish’ pushbutton should be pressed.

The ‘exit’ pushbutton should be pressed to complete the numerical edit.

11 PARAMETER STATUS DISPLAY

The user interface in the ICENI/MA-03 provides the following screens to display signal values and status:

11.1 Display of Signal Conditioning Module Status Information

11.1.1 (Master) Active Modules Screen [MAVA01]

Access: at power up or on return to master

Following power up of the ICENI/MA-03 and node configuration, the display automatically defaults to a screen showing the status of each of the signal conditioning modules within the node. For each module that has been successfully discovered and configured, the ICENI/MA-03 will display the module number on the screen in up to four rows of four numbers.

If a module has not been discovered during the configuration process, no number will be shown for that module number.

If a module has been discovered and it remains healthy, the module number will be shown in solid white characters.

If a module has been discovered but then becomes unhealthy, the module number will be shown in flashing red characters.

The node state will be displayed in this screen after power up of the ICENI/MA-03 and node configuration has completed.

11.2 Display of Signal Value Information

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press signal conditioning pushbutton
↓
(module x) Signal Values Screen [SCVA01]

The ICENI/MA-03 will display channel values for each of the module channels that are provided.

If a channel is healthy then the ‘real world’ value will be displayed.

If a channel is not healthy then a fault or alarm status will be displayed in place of the ‘real world’ value.

11.3 Display of Other Status Information

11.3.1 (Master) General Information

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press 'MA Info' pushbutton
↓
(Master) General Screen [MAIN01]

- o 'MAC ID' : the DeviceNet node identity
- o 'Baud Rate': the current used CANbus baud rate
- o 'Alarm O/P': if a signal conditioning module has failed, or no modules have been discovered during configuration then this parameter will show 'fault' otherwise the system is healthy and will show 'healthy'
- o 'CANBusSta': CANbus communication status

11.3.2 (Master) Build Information

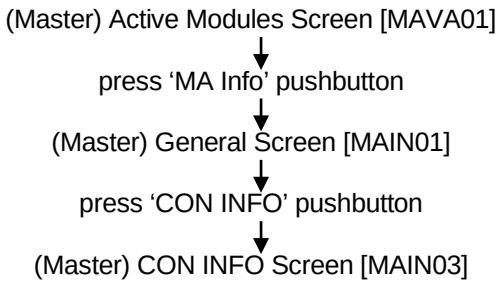
The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press 'MA Info' pushbutton
↓
(Master) General Screen [MAIN01]
↓
press 'Build' pushbutton
↓
(Master) Build Screen [MAIN02]

- o Screen title description of the master module
- o 'Part No': the part number of the master module
- o 'S/W version': the version of software running in the master module
- o 'S/W issue': the issue of software running in the master module

11.3.3 (Master) CON_INFO

The device's connection status can be located in the user interface via the following navigation:



- o 'Explic': explicit messaging connection status
- o 'Polled': poll message connection status
- o 'Mulpoll': multicast poll message connection status
- o 'BitStro': bit-strobe message connection status
- o 'COS': change of Status message connection status
- o 'Cyclic': cyclic message connection status
- o 'COS/Cyc': change of state/cyclic message connection status
- o 'ACKStatus': acknowledge status

11.3.4 (Master) DIAGNOSE

The low level CANbus communication status and dynamic established explicit connection information can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press 'MA Info' pushbutton
↓
(Master) General Screen [MAIN01]
↓
press '*DIAGNOSE*' pushbutton
↓
(Master) *DIAGNOSE* Screen [MAIN04]

- o 'TX ErrCount': total number of transmit errors
- o 'RX ErrCount': total number of receive errors
- o 'Message': invalid message interrupt status
- o 'Interrup': error interrupt status
- o 'RX Buffer': RX buffer overflow interrupt status
- o 'TXMSGMaxQue': maximum number of TX message in the queue waiting to be sent
- o 'RXMSGMaxQue': maximum number of RX message in the queue waiting to be processed
- o 'Dynamic EMC': number of dynamic established explicit message connections

11.3.5 (Master) DIAGNOSE > MOREINFO

The Iceni product code and serial number info can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press 'MA Info' pushbutton
↓
(Master) General Screen [MAIN01]
↓
press '*DIAGNOSE*' pushbutton
↓
(Master) *DIAGNOSE* Screen [MAIN04]
↓
press '*MOREINFO*' pushbutton
↓
(Master) *MOREINFO* Screen [MAIN05]

- o 'DN-PC': DeviceNet product code
- o 'DN-SN': DeviceNet serial number

11.3.6 (Signal Conditioning) Build Information

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press signal conditioning pushbutton
↓
(module x) Signal Values Screen [SCVA01]
↓
press 'Info' button
↓
(module x) Build Screen [SCIN01]

- o Screen title: a description of the signal conditioning module
- o 'Part No': the part number of the signal conditioning module
- o 'S/W version': the version of software running in the signal conditioning module
- o 'S/W issue': the issue of software running in the signal conditioning module

12 PARAMETER CONFIGURATION

The user interface in the ICENI/MA-03 provides the functionality to adjust and configure parameters.

12.1 ICENI/MA-03 Isolation During Configuration

During configuration and storage of any parameters, the ICENI/MA-03 module will isolate itself from both the field communications network, and from communications with signal conditioning modules (any outputs will revert to their failsafe conditions). This ensures a safe and stable environment within which to configure parameters.

Communications will commence again once the ICENI/MA-03 has completed setup mode. The DeviceNet network interface will be reset before communications begin.

12.2 Configuration of General Operating Parameters

A number of general operating parameters are configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press ‘Setup’ button
↓
(Master) Edit / Default / External Params Screen [MASE01]
↓
press ‘Edit’ button
↓
(Master) Setup Confirmation Screen [MASE02]
↓
press ‘Accept’ button
↓
(Master) Setup Options Screen [MASE03]
↓
Move cursor to ‘General Config’
↓
press ‘Select’ button
↓
(Master) General Config Screen [MASE05]

12.2.1 Temperature Unit (°C / °F) Configuration

The parameter ‘Temperature as’ selects the temperature unit to be used (Celsius or Fahrenheit) and can be configured as °C or °F. (Edit is by selection from a list.)
Any ‘real world’ temperature values will be calculated according to the temperature unit in use.

12.3 Configuration of DeviceNet Interface General Parameters

A number of DeviceNet interface general parameters are configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press ‘Setup’ button
↓
(Master) Edit / Default / External Params Screen [MASE01]
↓
press ‘Edit’ button
↓
(Master) Setup Confirmation Screen [MASE02]
↓
press ‘Accept’ button
↓
(Master) Setup Options Screen [MASE03]
↓
Move cursor to ‘DeviceNetInterface’
↓
press ‘Select’ button
↓
(Master) DeviceNet Interface Screen [MASE07]
↓
Move cursor to ‘DeviceNet General’
↓
press ‘Select’ button
↓
(Master) DeviceNet General Screen [MASE08]

12.3.1 DeviceNet MAC ID Configuration

The DeviceNet node identity can be configured using the parameter ‘MAC ID’. (Edit is numerical).

12.3.2 DeviceNet Baud Rate Configuration

The CANbus baud rate can be configured using the parameter ‘baud rate’. (Edit is by selection from a list.)

12.3.3 DeviceNet Heartbeat Configuration

The DeviceNet heartbeat function can be configured using the parameter ‘Heartbt’ and selecting ‘disabled’ or ‘enabled. (Edit is by selection from a list.)

If ‘disabled’ was selected then the next parameter ‘Heartbt(ms)’ will automatically be set to 0, otherwise it will configure the heartbeat period. (Edit is numerical).

12.3.4 DeviceNet Communication Time Out Configuration

Setting ‘TimeOut’ value to non-zero will enable the TX / RX message monitoring function. ‘CANBusSta’ will be set to ‘Time Out’ if TX and RX messages have been stopped for the period of ‘TimeOut’ (displayed in 100ms) after IO connection has been established. (Edit is numerical.).

Setting ‘TimeOut’ value to zero will disable this TX / RX message monitoring function.

12.4 Configuration of Input Data

The data size of input data is configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press ‘Setup’ button
↓
(Master) Edit / Default / External Params Screen [MASE01]
↓
press ‘Edit’ button
↓
(Master) Setup Confirmation Screen [MASE02]
↓
press ‘Accept’ button
↓
(Master) Setup Options Screen [MASE03]
↓
Move cursor to ‘DeviceNetInterface’
↓
press ‘Select’ button
↓
(Master) DeviceNetInterface Screen [MASE07]
↓
Move cursor to ‘Input Data Config’
↓
press ‘Select’ button
↓
(Master) Channel Data Type Screen [MASE15]

12.4.1 1bit Status Info Configuration

Every channel has status either ‘healthy’ (bit clear (0)) or ‘unhealthy’ (bit set (1)) (the attribute 4 of discrete input/output point object and analogue input/output point object). The node has this information available for each channel (called ‘1bit status’). This information can be sent out with input channel data if ‘None’ is not selected.

Edit is by selection from the following options:

All chan	- all IO channels
AI chan	- analogue Input channels only
DI chan	- digital Input channels only
IN chan	- all Input channels only
AO chan	- analogue output channels only
DO chan	- digital output channels only
OUT chan	- all output channels only
ANA chan	- all analogue channels only
DIG chan	- all digital channels only
None	- exclude channel 1 bit status info

12.4.2 1byte Status Info Configuration

The detailed channel status (called '1byte status') is available in the node (the attribute 100 of discrete input/output point object and analogue input/output point object). The contents of the channel status will depend upon the specific type of signal supported by the Iceni signal conditioning module. Details of the status codes are provided in the instruction manual for the specific signal conditioning module.

1 byte status for each channel can be sent out with input channel data if 'None' is not selected.

Edit is by selection from the following options:

All Anal	- all analogue channels
AI chan	- analogue Input channels only
AO chan	- analogue output channels only
None	

12.4.3 Node Status Info Configuration

Node status info is 32 bits long (the attribute 100 of Identity object).

The following information is displayed:

Bit 0:	Heartbeat. The bit toggles between 0 and 1 every 'Heartbeat Interval' seconds if 'Heartbeat Interval' is not set to 0; the bit toggles every half second if 'Heartbeat Interval' is set to 0.
Bits 1-7:	reserved
Bits 8-12:	number of module in the node
Bits 13-15:	reserved
Bits 16 – 31:	bit mapping for module status. Bit 16 for module 1, bit 17 for module 2,…., bit 31 for module 16. (bit set (1) is healthy; bit clear (0) is unhealthy or not available)

The node info can be sent out with input data if enabled.

Edit is by selection from the following options:

Disabled	- include node status info
Enabled	- exclude node status info

12.5 Configuration of Signal Channel Types

The selection of a particular signal type (e.g., a thermocouple module may support a number of different sensor types for each signal channel) is configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press signal conditioning pushbutton
↓
(module x) Signal Values Screen [SCVA01]
↓
press ‘Setup’ button
↓
(module x) Setup Confirmation Screen [SCSE01]
↓
press ‘Accept’ button
↓
(module x) Setup Options Screen [SCSE02]
↓
Move cursor to ‘Channel Signals’
↓
press ‘Select’ button
↓
(module x) Channel Selection Screen [SCSE03]
↓
Move cursor to channel of choice
↓
press ‘Select’ button
↓
(module x) Channel x Type Screen [SCSE04]

The screen will present the various signal type options for the specific signal channel that can be configured. (Edit is by selection from a list.)

12.6 Configuration of Output Channel Fault Action

The selection of output channel fault action is configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press signal conditioning pushbutton
↓
(module x) Signal Values Screen [SCVA01]
↓
press ‘Setup’ button
↓
(module x) Setup Confirmation Screen [SCSE01]
↓
press ‘Accept’ button
↓
(module x) Setup Options Screen [SCSE02]
↓
Move cursor to ‘Output FaultAction’
↓
press ‘Select’ button
↓
(module x) Channel Selection Screen [SCSE19]
↓
Move cursor to channel of choice
↓
press ‘Select’ button
↓
(module x) Channel x Fault Action Screen [SCSE21] if channel is digital or Screen [SCSE22] if channel is analogue

The screen will present the various fault action options for the specific signal channel that can be configured. (Edit is by selection from a list.)

12.7 Configuration of output channel fault value

The selection of output channel fault value is configurable via the user interface.

The parameters can be located in the user interface via the following navigation:

(Master) Active Modules Screen [MAVA01]
↓
press signal conditioning pushbutton
↓
(module x) Signal Values Screen [SCVA01]
↓
press ‘Setup’ button
↓
(module x) Setup Confirmation Screen [SCSE01]
↓
press ‘Accept’ button
↓
(module x) Setup Options Screen [SCSE02]
↓
Move cursor to ‘Output FaultValue’
↓
press ‘Select’ button
↓
(module x) Channel Selection Screen [SCSE20]
↓
Move cursor to channel of choice
↓
press ‘Select’ button
↓
(module x) Channel x Fault Value Screen [SCSE23] if channel is digital or Screen [SCSE24] if channel is analogue

The screen will present option to edit the fault value. (Edit is numerical.)

13 PARAMETER STORAGE

The user interface in the ICENI/MA-03 provides the functionality to store configured parameters to EEPROM so that they are retained during power loss / power down.

13.1 Storage of Internally configured Parameters

Following configuration of parameters via the user interface, the user is prompted to store, use or cancel.

'Store'

If 'store' is selected then the configured parameters will be stored in EEPROM memory and the new values will become active within the operation of the node.

'Use'

If 'use' is selected then the configured parameters will be used until next power down whereby the previous values prior to configuration will be restored.

'Cancel'

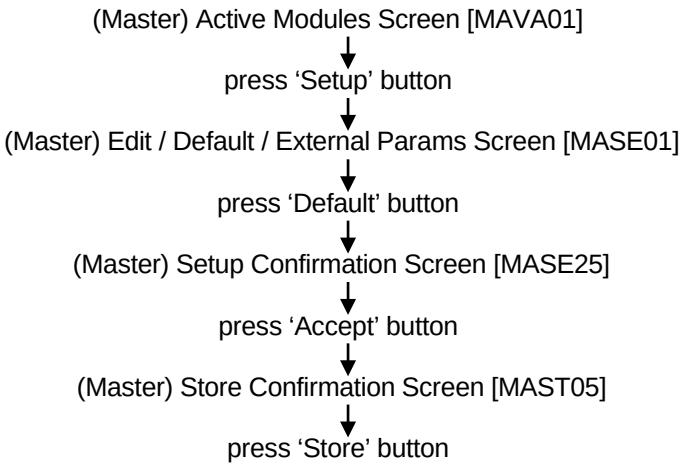
If 'cancel' is selected then the configured parameters will be return to their previous values prior to configuration.

Parameter storage to EEPROM will commence (if 'store' was selected) and once complete, the display will return to (Master) Active Modules Screen [MAIN01] or the (module x) Signal Values Screen [SCVA01].

13.2 Setting Parameters to Factory Default Values

All edited parameters can be reset to their factory default values and stored to EEPROM.

In order to store the parameters, the following sequence should be followed:

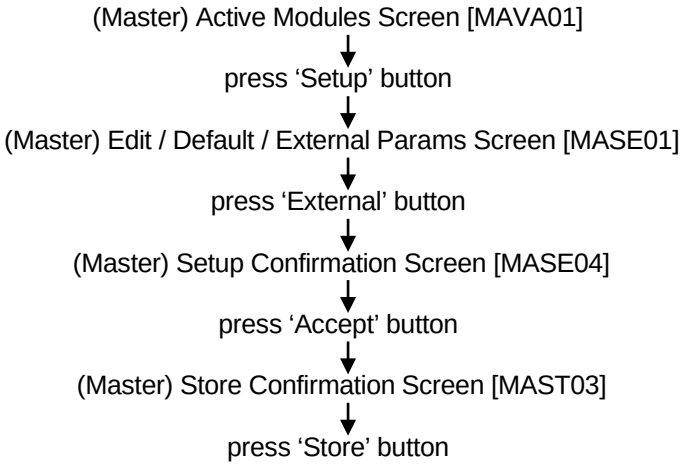


Storage of all parameters to EEPROM will commence (if 'store' was selected) and once complete, the display will return to (Master) Active Modules Screen [MAIN01].

13.3 Storage of Externally Configured Parameters

Following configuration of parameters (only for output channel *Fault Action* and *Fault Value*) via an external configuration tool (not from the user interface menu), the user is prompted to store the parameters to EEPROM so that they are retained during power loss / power down.

In order to store externally configured values, the following sequence should be followed:



Externally configured parameter storage to EEPROM will commence if 'store' was selected and once complete, the display will return to (Master) Active Modules Screen [MAIN01].

Notes:

a) The parameters that will be saved in this action are output channel *Fault Action* which is Discrete Output Point Object instance attributes 5 or Analog Output Point Object instance attributes 9, and *Fault Value* which is Discrete Output Point Object instance attributes 6 or Analog Output Point Object instance attributes 11.

b) Output channel *Fault Action* and *Fault Value* can be edited via the user interface menu. In this case, data can be saved into EEPROM if 'store' is selected during editing, and there is no need to perform an external save.

14 DEVICENET FIELD COMMUNICATIONS NETWORK

14.1 ICENI/MA-03 Functionality

The ICENI / MA-03 module is compliant with ODVA standards: the CIP Networks Library: DeviceNet Adaptation of CIP Volume 3 Edition 1.12 and the CIP Networks Library: Common Industrial Protocol Volume 1 Edition 3.11.

ICENI / MA-03 module is designed as a Group 2 slave type device. Polled I/O messaging, Change of State (COS) messaging, Cyclic I/O messaging, Bit-Strobe message and Multicast poll message are supported to pass channel value / status information from / to a DeviceNet master.

ICENI / MA-03 also includes the following functions:

- Input data is configurable through the user interface menu
- MAC ID, baud rate and heartbeat interval are configurable through the user interface menu.
- Output channel fault action and value are configurable through the user interface menu
- Channel type is configurable through user the interface menu
- Communication and module / channel error diagnostics

14.2 Objects Supported

The objects supported by ICENI/MA-03 and the number of instances for each object are listed in the table below.

Object Class	Class Code	Number of instances
Identity Object	0x01	1
Message Router Object	0x02	1
DeviceNet Object	0x03	1
Connection Object	0x05	5
Acknowledge Handler Object	0x2B	1
Assembly Object	0x04	3
Discrete Input Point Object	0x08	Per channel (Max 128)[2]
Discrete Output Point Object	0x09	Per channel (Max 128)
Analogue Input Point Object	0x0A	Per channel (Max 128)
Analogue Output Point Object	0x0B	Per channel (Max 128)

[2] The instance number counting starts from left to right (e.g. number of a channel in a module on the left is smaller than number of same channel in the same type of module on the right). This rule applies to 'Discrete Input Point Object', 'Discrete Output Point Object', 'Analogue Input Point Object' and 'Analogue Output Point Object'.

14.2.1 DeviceNet Object (Class Code 0x03)

Class Attributes

Attr ID	Access Rule	NV[3]	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	1, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	MAC ID	USINT	63, Range 0-63	Node Address
2	Get	NV	Baud Rate	USINT	2, Range 0-2	Baud Rate
3	Get	NV	BOI	BOOL	1	Bus–Off Interrupt
4	Get/Set	V	Bus–Off Counter	USINT	Range 0–255	Number of times CAN went to the bus–off state
5	Get	V	Allocation Info	STRUCT of:		
			Allocation Choice Byte	BYTE		
			Master's MAC ID	USINT	Range 0–63, 255 Modified via Allocate only.	MAC ID of Master (from Allocate)
6	Get	V	MAC ID Switch Changed	BOOL	0: No Change 1: Change since last Reset or Power–up.	The Node Address Switch(es) have changed since last power–up/reset.
7	Get	V	Baud Rate Switch Changed	BOOL	0: No change 1: Change since last Reset or Power–up.	The Baud Rate Switch(es) have changed since last power–up/reset.
8	Get	V	MAC ID Switch Value	USINT	Range 0–99	Actual value of Node Address switch(es)
9	Get	V	Baud Rate Switch Value	USINT	Range 0-9	Actual value of Baud Rate switch(es)

Class Specific Services

Service Code	Service Name	Service Description
0x4B	Allocate_Master/Slave_Connection_Set	Requests the use of the Predefined Master/Slave Connection Set
0x4C	Release_Master/Slave_Connection_Set	Indicates that the specified Connections within the Predefined Master/Slave Connection Set are no longer desired. These Connections are to be released (Deleted)

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Used to read a DeviceNet Object and instance attribute value
0x10	Set_Attribute_Single	Used to modify instance attribute value

NV indicates whether an attribute value is maintained through power cycles. This column is used in object definitions where non-volatile storage of attribute values is required. An entry of '**NV**' indicates value shall be saved; '**V**' means not saved.[3]

14.2.2 Identity Object (Class Code 0x01)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	1, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based. See description below for more details.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Vendor ID	UINT	4110	Identification of each vendor by number
2	Get	NV	Device Type	UINT	43	Indication of general type of product
3	Get	NV	Product Code	UINT	03	Identification of a particular product of an individual vendor
4	Get	NV	Revision	STRUCT of:		Revision of the item the Identity Object represents
			Major Revision	USINT		
			Minor Revision	USINT		
5	Get	V	Status	WORD		Summary status of device
6	Get	NV	Serial Number	UDINT		Serial number of device
7	Get	NV	Product Name	SHORT_ STRING	RE ICENI	Human readable identification
8	Get	V	State	USINT	0: Nonexistent 1: Device Self Testing 2: Standby 3: Operational 4: Major Recoverable Fault 5: Major Unrecoverable Fault 6 – 254 Reserved 255: Default for Get_Attributes_All service	Present state of the device as represented by the state transition diagram
10	Get	NV	Heartbeat Interval	USINT	The default value is 0. Zero disables transmission of the heartbeat message.	The nominal interval between heartbeat messages in seconds.
100	Get	V	Node status	UDINT	Bit 0: Heartbeat. The bit toggled between 0 and 1 every ‘Heartbeat Interval’ seconds if ‘Heartbeat Interval’ is not set to zero; the bit will toggle every half second if ‘Heartbeat Interval’ is set to zero Bits 1-7: Reserved Bits 8-12: Number of module in the node Bits 13-15: Reserved Bits 16 – 31: Bit mapping for module status. Bit 16 for module 1; bit 17 for module 2….; bit 31 for module 16. (bit set (1) is healthy; bit clear (0) is unhealthy or not available)	Node information

Class and Instance Services

Service Code	Service Name	Service Description
0x01	Get_Attributes_All	Returns a predefined listing of this instance attributes
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.
0x05	Reset	Invokes the Reset service for the device.

14.2.3 Connection Object (Class Code 0x05)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values
1	Get	NV	Revision	UNIT	1, Range 1–65535

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	value	Attribute Description
1	Get	V	State	USINT		State of the object
2	Get	V	Instance_type	USINT		Indicates either I/O or Messaging Connection
3	Get	V	TransportClass_trigger	BYTE		Defines behavior of the Connection
4	Get	V	Produced_connection_id	UINT		Placed in CAN Identifier Field when the Connection transmits on a DeviceNet subnet.
5	Get	V	Consumed_connection_id	UINT		CAN Identifier Field value that denotes message to be received on a DeviceNet subnet.
6	Get	V	Initial_comm_characteristics	BYTE		Defines the Message Group(s) across which productions and consumptions associated with this Connection occur on a DeviceNet subnet.
7	Get	V	Produced_connection_size	UINT		Maximum number of bytes transmitted across this Connection
8	Get	V	Consumed_connection_size	UINT		Maximum number of bytes received across this Connection
9	Get/Set	V	Expected_packet_rate	UINT		The timing associated with this Connection
12	Get/Set	V	Watchdog_timeout_action	USINT		Defines how to handle Inactivity / Watchdog timeouts
13	Get	V	Produced_connection_path_length	UINT		Number of bytes in the produced_connection_path attribute
14	Get	V	Produced_connection_path	Packed EPATH		The Application Object(s) whose data is to be produced by this Connection Object.
15	Get	V	Consumed_connection_path_length	UINT		Number of bytes in the consumed_connection_path attribute
16	Get	V	Consumed_connection_path	Packed EPATH		The Application Object(s) that are to receive the data consumed by this Connection Object.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Used to read a Connection Object or instance attribute.
0x10	Set_Attribute_Single	Used to modify a Connection instance attribute.

Instance 1 (Explicit Message Connection)

The Explicit message connection is used to get / set attribute of object or instance.

Instance 2 (Polled Message Connection)

The Poll Message Connection is used to transmit a poll command (request) from master towards a slave, and the poll response from slave to the Master. The master poll command (request) could include data for all output channels. The slave response message will include all input channels value, and channel / node status if selected from Iceni user interface menu. Within a Slave, the Poll Command and Response Messages are received / transmitted by a single Connection Object.

Master poll request data (witch is consumed by ICENI/MA-03) should be mapped to assembly instance 2 attribute 3 (Data); the poll response data from ICENI/MA-03 is mapped to assembly instance 1 attribute 3 (Data).

Instance 3 (Bit-Strobe Message Connection)

The Bit–Strobe Message Connection is used to transmit a Bit–Strobe Command Message from master to slaves and response message from slave to master. Multiple Slaves can receive and react to the same Bit-Strobe Command (multi–cast capabilities). Within a Slave, the Bit–Strobe Command and Response Messages are received / transmitted by a single Connection Object.

ICENI/MA-03 will consume the master Bit–Strobe Command as a trigger and ignore the output data, the Bit-Strobe response data from ICENI/MA-03 is mapped to Identity Object instance 1 attribute 0x64 (Node Status) (e.g.: the Iceni/MA-03 Bit–Strobe Response message will only contain node status info, and there is no input channel value / channel status info in the response message).

Instance 4 (Change of State/Cyclic Message Connection)

The Change of State/Cyclic Message is transmitted by either the Master or the Slave. A Change of State/Cyclic Message is directed towards a single specific node (point-to-point). An Acknowledge Message may be returned in response to this message. Within either the Master or the Slave, the producing Change of State Message and consuming Acknowledge Message are received / transmitted by one connection object. The consuming Change of State Message and producing Acknowledge Message are received / transmitted by a second connection object.

The Change of State Message produced by master could include data for all output channels. The data should be mapped to assembly instance 2 attribute 3 (Data).

The Change of State Message produced by Iceni / MA-03 includes all input channels value, and channel / node status if selected from Iceni / MA-03 user interface menu. The data is mapped to assembly instance 1 attribute 3 (Data).

Instance 5 (Multicast Poll Message Connection)

The Multicast Poll *Command* is an I/O Message that is transmitted by the Master. A Multicast Poll is directed towards one or more Slaves. The Multicast Poll *Response* is an I/O Message that a Slave transmits back to the Master when the Multicast Poll Command is received. Within a Slave, the Multicast Poll Command and Response Messages are received / transmitted by a single Connection Object.

The Iceni / MA-03 device will consume the master Multicast Poll Command as a trigger and ignore the output data. The response message from Iceni / MA-03 will include node status, all analogue channels one byte status and all digital channels one bit status (there is no input channel value in the response message). The data is mapped to assembly instance 3 attribute 3 (Data).

14.2.4 Discrete Input Point (Class Code 0x08)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	2, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based. See description below for more details.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	V	Number of Attributes	USINT	5	Number supported in this product
2	Get	V	Attribute List	Array Of USINT	{1,2,3,4, 100}	List of attributes supported in this product
3	Get	V	Value	BOOL	0: off 1: on	Input point value
4	Get	V	State	BOOL	0: OK 1: product specific alarm or status	Input point status
100	Get	V	Channel Status	BYTE	0-255	Status of this digital input channel. The contents of the channel status will depend upon the specific type of signal supported by the Iceni signal conditioning module. Details of the status codes are provided in the instruction manual for the specific signal conditioning module.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.

14.2.5 Discrete Output Point (Class Code 0x09)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	2, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based. See description below for more details.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	V	Number of Attributes	USINT	7	Number supported in this product
2	Get	V	Attribute List	Array Of USINT	{1,2,3,4,5,6,100}	List of attributes supported in this product
3	Set	V	Value	BOOL	0: off 1: on	Output point value
4	Get	V	State	BOOL	0: OK 1: product specific alarm or status	Output point status
5	Set	NV	Fault Action	BOOL	0: Fault Value attribute; 1: hold last state	Action taken on output's value in Recoverable Fault state
6	Set	NV	Fault Value	BOOL	0: off 1: on	Default value 0 (off) (User–defined value for use with Fault State attribute)
100	Get	V	Channel Status	BYTE	0-255	Status of this digital output channel. The contents of the channel status will depend upon the specific type of signal supported by the Iceni signal conditioning module. Details of the status codes are provided in the instruction manual for the specific signal conditioning module.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.
0x10	Set_Attribute_Single	Modifies an instance attribute value.

14.2.6 Analogue Input Point (Class Code 0x0A)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	2, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based. See description below for more details.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	V	Number of Attributes	USINT	5	Number supported in this product
2	Get	V	Attribute List	Array Of USINT	{1,2,3,4, 100}	List of attributes supported in this product
3	Get	V	Value	INT		Analog input value.
4	Get	V	State	BOOL	0: OK 1: product specific alarm or status	Indicates if a fault or alarm has occurred.
100	Get	V	Channel Status	BYTE	0-255	Status of this analogue input channel. The contents of the channel status will depend upon the specific type of signal supported by the Iceni signal conditioning module. Details of the status codes are provided in the instruction manual for the specific signal conditioning module.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.

14.2.7 Analog Output Point (Class Code 0x0B)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	2, Range 1–65535	Revision of the DeviceNet Object Class Definition upon which the implementation is based. See description below for more details.

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	V	Number of Attributes	USINT	7	Number supported in this product
2	Get	V	Attribute List	Array Of USINT	{1,2,3,4,9,11,100}	List of attributes supported in this product
3	Set	V	Value	INT		Analog output value.
4	Get	V	State	BOOL	0: OK 1: product specific alarm or status	Indicates if a fault or alarm has occurred.
9	Set	NV	Fault Action	USINT	0: hold last state (default) 1: low limit1 2: high limit 3: use Fault Value 4 – 99: reserved 100 – 199: vendor specific 200 – 299: reserved	Output value to go to on failure or fault
11	Set	NV	Fault Value	INT		User defined value outputs go to in fault mode if Fault State = 3, user specified value
100	Get	V	Channel Status	BYTE	0-255	Status of this analogue output channel. The contents of the channel status will depend upon the specific type of signal supported by the Iceni signal conditioning module. Details of the status codes are provided in the instruction manual for the specific signal conditioning module.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.
0x10	Set_Attribute_Single	Modifies an instance attribute value.

14.2.8 Assembly Object (Class Code 0x04)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	2, Range 1–65535	Revision of this object

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	V	Number of members in list	UINT		
2	Get	V	Member list	Array of USINT		The member list is an array of CIP paths
			Member data description	UINT		Size of member data in bits.
			Member path size	UINT		Size of Member Path in bytes.
			Member path	Packed EPATH		
3	Get/Get	V	Data	Array of BYTE		Get for input data; Set for output data.
4	Get	V	Size	UINT		Number of bytes in attribute 3

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.
0x10	Set_Attribute_Single	Modifies an instance attribute value.

Instances 1 for all input data and selected status

Data Format

Byte Order	Number of Bytes	Member Class		Member Instance	Member Attribute		
		Name	No.		Name	No.	Data Type
Low	2n	Analogue Input Point	0x0A	n	Data	0x03	UINT
	m/8 + 1(if m%8 != 0)	Discrete Input Point	0x08	m	Data	0x03	BOOL
		Reserved bits (set to 0)		(no. of digital input channels) % 8			BOOL
	0 or 4	Identity (if node status is selected from menu)	0x01	0 or 1	Node status	0x64	UDINT
	0 or n (if selected)	Analogue Input Point (if 1 byte status is selected from menu)	0x0A	0 or n	Channel Status	0x64	BYTE
	0 or i (if selected)	Analogue Output Point (if 1 byte status is selected from menu)	0x0B	0 or i	Channel Status	0x64	BYTE
	0 or Max (if all channels are selected): (n+m+i+j)/8 + 1 (if (n+m+i+j)%8 != 0)	Analogue Input Point (if 1 bit status is selected from menu)	0x0A	0 or n	Status	0x04	BOOL
		Discrete Input Point (if 1 bit status is selected from menu)	0x08	0 or m	Status	0x04	BOOL
		Analogue Output Point (if 1 bit status is selected from menu)	0x0B	0 or i	Status	0x04	BOOL
High		Discrete Output Point (if 1 bit status is selected from menu)	0x09	0 or j	Status	0x04	BOOL
		Reserved bits (set to 0)		(total selected no. of channels for status) % 8			BOOL

Instances 2 for all output data

Data Format

Byte Order	Number of Bytes	Member Class		Member Instance	Member Attribute		
		Name	No.		Name	No.	Data Type
Low	2i	Analogue Input Point	0x0A	i	Data	0x03	UINT
	j / 8 + 1(if j % 8 != 0)	Discrete Input Point	0x08	j	Data	0x03	BOOL
		Reserved bits (set to 0)		(no. of digital input channels) % 8			BOOL
High							

Instances 3 for node and all channels status

Data format

Byte Order	Number of Bytes	Member Class		Member Instance	Member Attribute		
		Name	No.		Name	No.	Data Type
Low	4	Identity	0x01	1	Node status	0x64	UDINT
	n	Analogue Input Point	0x0A	n	Channel Status	0x64	BYTE
	i	Analogue Output Point	0x0B	i	Channel Status	0x64	BYTE
High	(m+j) / 8 + 1 (if (m+j) % 8 != 0)	Discrete Input Point	0x08	m	Status	0x04	BOOL
		Discrete Output Point	0x09	j	Status	0x04	BOOL
		Reserved bits (set to 0)		(m+j) % 8			BOOL

14.2.9 Acknowledge Handler Object (Class Code 0x2B)

Class Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Get	NV	Revision	UNIT	1, Range 1–65535	Revision of this object

Instance Attributes

Attr ID	Access Rule	NV	Attribute Name	Data Type	Values	Attribute Description
1	Set	V	Acknowledge Timer	UINT	Range 1-65,535ms (0 invalid) (default 16)	Time to wait for acknowledge before resending
2	Get/Set	V	Retry Limit	Array of BYTE	Range 0-255 (default 1)	Number of Ack Timeouts to wait before informing the producing application of a RetryLimit_Reached event.
3	Set/Get	V	COS Producing Connection Instance	UINT	Connection Instance ID	Connection Instance which contains the path of the producing I/O application object which will be notified of Ack Handler events.

Class and Instance Services

Service Code	Service Name	Service Description
0x0E	Get_Attribute_Single	Returns the contents of the object or instance specified attribute.
0x10	Set_Attribute_Single	Modifies an instance attribute value.

14.2.10 Message Router Object (Class Code 0x2)

No attribute is implemented.

14.3 Error Handling

14.3.1 TX / RX Time Out error

By setting ‘TimeOut’ in menu DEVICENET GENERAL to a non-zero value, CAN bus TX and RX time out errors can be detected. The ‘Timeout’ errors will be set if TX or RX interrupts have not be active for more than ‘TimeOut’ after IO connection has been established.

14.3.2 CAN Communication error

Can communication status is monitored by ICENI/MA-03. The communication status information will be displayed in page (Master) [MAIN03] MA INFO > General and MA INFO > DIAGNOSE (see section 11.3.4 (Master) DIAGNOSE).

14.3.3 Duplicated MAC ID

The ICENI/MA-03 will display ‘ERR DUP MACID’ in status of master page [MAVA01] if the device fails its power-up Duplicate MAC ID test and the unit MAC ID is et via the user interface menu (see section 12.3 Configuration of DeviceNet Interface General Parameters).

14.3.4 Module, Channel Error

Channel and module status are monitored by ICENI/MA-03. Active module numbers are displayed in master page [MAVA01]. The number will be flashed in red if a module has failed or is lost. The details of channel status are displayed in page [SCVA01]. If a channel is healthy then the ‘real world’ value will be displayed. If a channel is not healthy then a fault or alarm status will be displayed in place of the ‘real world’ value (see section 11.2 Display of Signal Value Information).

15 CANBUS TIMING

The CANbus bit encoding / decoding and synchronization meets the requirements defined in ISO11898-1.

The following table describes the bit-rate, bit timing and sample point supported by the Iceni master module.

Bit rate (kbit/s)	Baud Rate Period For One Bit (µs)	Location of Sample Point (%)	Estimated Maximum Bus Length (m)
125	8	87.5	500
250	4	87.5	250
500	2	87.5	100

16 EXAMPLES

16.1 Modules in a Node

An example node has:

- 1 ICENI/MA-3 module.
- 1 power supply.
- 2 analogue input modules. One module has 4 channels; the other has 5 channels.
- 2 digital input modules. One module has 8 channels; the other has 4 channels.
- 1 analogue output module. The module has 4 channels.
- 1 digital output module. The module has 4 channels.

16.2 Assembly Instances

16.2.1 Assembly Instance 1

16.2.1.1 If node status, analogue channels 1byte status and all channels 1bit status are selected

Data Size: 41 Bytes

I/O Assembly Data Attribute Mapping for Input Data

Component Name	Class		Instance No.	Attribute		Data Type	Bytes (bit)
	Name	No.		Name	No.		
Analogue Input	Analog Input Point Object	0x0A	1	Value	3	INT	0,1
Analogue Input	Analog Input Point Object	0x0A	2	Value	3	INT	2,3
Analogue Input	Analog Input Point Object	0x0A	3	Value	3	INT	4,5
Analogue Input	Analog Input Point Object	0x0A	4	Value	3	INT	6,7
Analogue Input	Analog Input Point Object	0x0A	5	Value	3	INT	8,9
Analogue Input	Analog Input Point Object	0x0A	6	Value	3	INT	10,11
Analogue Input	Analog Input Point Object	0x0A	7	Value	3	INT	12,13
Analogue Input	Analog Input Point Object	0x0A	8	Value	3	INT	14,15
Analogue Input	Analog Input Point Object	0x0A	9	Value	3	INT	16,17
Digital Input	Discrete Input Point Object	0x08	1	Value	3	BOOL	18(0)
Digital Input	Discrete Input Point Object	0x08	2	Value	3	BOOL	18(1)
Digital Input	Discrete Input Point Object	0x08	3	Value	3	BOOL	18(2)
Digital Input	Discrete Input Point Object	0x08	4	Value	3	BOOL	18(3)
Digital Input	Discrete Input Point Object	0x08	5	Value	3	BOOL	18(4)
Digital Input	Discrete Input Point Object	0x08	6	Value	3	BOOL	18(5)
Digital Input	Discrete Input Point Object	0x08	7	Value	3	BOOL	18(6)
Digital Input	Discrete Input Point Object	0x08	8	Value	3	BOOL	18(7)
Digital Input	Discrete Input Point Object	0x08	9	Value	3	BOOL	19(0)
Digital Input	Discrete Input Point Object	0x08	10	Value	3	BOOL	19(1)
Digital Input	Discrete Input Point Object	0x08	11	Value	3	BOOL	19(2)
Digital Input	Discrete Input Point Object	0x08	12	Value	3	BOOL	19(3)
Reserved bit						BOOL	19(4)
Reserved bit						BOOL	19(5)
Reserved bit						BOOL	19(6)
Reserved bit						BOOL	19(7)
Node status	Identify Object	0x01	1	Node Status	100	LONG	20 to 23
Analogue Input Channel status	Analog Input Point Object	0x0A	1	Channel status	100	BYTE	24
Analogue Input Channel status	Analog Input Point Object	0x0A	2	Channel status	100	BYTE	25
Analogue Input Channel status	Analog Input Point Object	0x0A	3	Channel status	100	BYTE	26
Analogue Input Channel status	Analog Input Point Object	0x0A	4	Channel status	100	BYTE	27
Analogue Input Channel status	Analog Input Point Object	0x0A	5	Channel status	100	BYTE	28
Analogue Input Channel status	Analog Input Point Object	0x0A	6	Channel status	100	BYTE	29
Analogue Input Channel status	Analog Input Point Object	0x0A	7	Channel status	100	BYTE	30
Analogue Input Channel status	Analog Input Point Object	0x0A	8	Channel status	100	BYTE	31
Analogue Input Channel status	Analog Input Point Object	0x0A	9	Channel status	100	BYTE	32
Analogue Output Channel status	Analog Output Point Object	0x0B	1	Channel status	100	BYTE	33
Analogue Output Channel status	Analog Output Point Object	0x0B	2	Channel status	100	BYTE	34
Analogue Output Channel status	Analog Output Point Object	0x0B	3	Channel status	100	BYTE	35

Analogue Output Channel status	Analog Output Point Object	0x0B	4	Channel status	100	BYTE	36
Analogue Input status	Analog Input Point Object	0x0A	1	Status	4	BOOL	37(0)
Analogue Input status	Analog Input Point Object	0x0A	2	Status	4	BOOL	37(1)
Analogue Input status	Analog Input Point Object	0x0A	3	Status	4	BOOL	37(2)
Analogue Input status	Analog Input Point Object	0x0A	4	Status	4	BOOL	37(3)
Analogue Input status	Analog Input Point Object	0x0A	5	Status	4	BOOL	37(4)
Analogue Input status	Analog Input Point Object	0x0A	6	Status	4	BOOL	37(5)
Analogue Input status	Analog Input Point Object	0x0A	7	Status	4	BOOL	37(6)
Analogue Input status	Analog Input Point Object	0x0A	8	Status	4	BOOL	37(7)
Analogue Input status	Analog Input Point Object	0x0A	9	Status	4	BOOL	38(0)
Digital Input status	Discrete Input Point Object	0x08	1	Status	4	BOOL	38(1)
Digital Input status	Discrete Input Point Object	0x08	2	Status	4	BOOL	38(2)
Digital Input status	Discrete Input Point Object	0x08	3	Status	4	BOOL	38(3)
Digital Input status	Discrete Input Point Object	0x08	4	Status	4	BOOL	38(4)
Digital Input status	Discrete Input Point Object	0x08	5	Status	4	BOOL	38(5)
Digital Input status	Discrete Input Point Object	0x08	6	Status	4	BOOL	38(6)
Digital Input status	Discrete Input Point Object	0x08	7	Status	4	BOOL	38(7)
Digital Input status	Discrete Input Point Object	0x08	8	Status	4	BOOL	39(0)
Digital Input status	Discrete Input Point Object	0x08	9	Status	4	BOOL	39(1)
Digital Input status	Discrete Input Point Object	0x08	10	Status	4	BOOL	39(2)
Digital Input status	Discrete Input Point Object	0x08	11	Status	4	BOOL	39(3)
Digital Input status	Discrete Input Point Object	0x08	12	Status	4	BOOL	39(4)
Analogue Output status	Analog Output Point Object	0x0B	1	Status	4	BOOL	39(5)
Analogue Output status	Analog Output Point Object	0x0B	2	Status	4	BOOL	39(6)
Analogue Output status	Analog Output Point Object	0x0B	3	Status	4	BOOL	39(7)
Analogue Output status	Analog Output Point Object	0x0B	4	Status	4	BOOL	40(0)
Digital Output status	Discrete Output Point Object	0x09	1	Status	4	BOOL	40(1)
Digital Output status	Discrete Output Point Object	0x09	2	Status	4	BOOL	40(2)
Digital Output status	Discrete Output Point Object	0x09	3	Status	4	BOOL	40(3)
Digital Output status	Discrete Output Point Object	0x09	4	Status	4	BOOL	40(4)
Reserved bit						BOOL	40(5)
Reserved bit						BOOL	40(6)
Reserved bit						BOOL	40(7)

16.2.1.2 If node status, analogue channels 1bit status are selected

Data Size: 28 Bytes

I/O Assembly Data Attribute Mapping for Input Data

Component Name	Class		Instance No.	Attribute		Data Type	Byte (bit)
	Name	No.		Name	No.		
Analogue Input	Analog Input Point Object	0x0A	1	Value	3	INT	0,1
Analogue Input	Analog Input Point Object	0x0A	2	Value	3	INT	2,3
Analogue Input	Analog Input Point Object	0x0A	3	Value	3	INT	4,5
Analogue Input	Analog Input Point Object	0x0A	4	Value	3	INT	6,7
Analogue Input	Analog Input Point Object	0x0A	5	Value	3	INT	8,9
Analogue Input	Analog Input Point Object	0x0A	6	Value	3	INT	10,11
Analogue Input	Analog Input Point Object	0x0A	7	Value	3	INT	12,13
Analogue Input	Analog Input Point Object	0x0A	8	Value	3	INT	14,15
Analogue Input	Analog Input Point Object	0x0A	9	Value	3	INT	16,17
Digital Input	Discrete Input Point Object	0x08	1	Value	3	BOOL	18(0)
Digital Input	Discrete Input Point Object	0x08	2	Value	3	BOOL	18(1)
Digital Input	Discrete Input Point Object	0x08	3	Value	3	BOOL	18(2)
Digital Input	Discrete Input Point Object	0x08	4	Value	3	BOOL	18(3)
Digital Input	Discrete Input Point Object	0x08	5	Value	3	BOOL	18(4)
Digital Input	Discrete Input Point Object	0x08	6	Value	3	BOOL	18(5)
Digital Input	Discrete Input Point Object	0x08	7	Value	3	BOOL	18(6)
Digital Input	Discrete Input Point Object	0x08	8	Value	3	BOOL	18(7)
Digital Input	Discrete Input Point Object	0x08	9	Value	3	BOOL	19(0)
Digital Input	Discrete Input Point Object	0x08	10	Value	3	BOOL	19(1)
Digital Input	Discrete Input Point Object	0x08	11	Value	3	BOOL	19(2)
Digital Input	Discrete Input Point Object	0x08	12	Value	3	BOOL	19(3)
Reserved bit						BOOL	19(4)
Reserved bit						BOOL	19(5)
Reserved bit						BOOL	19(6)
Reserved bit						BOOL	19(7)
Node status	Identify Object	0x01	1	Node status	100	LONG	20 to 23
Analogue Input status	Analog Input Point Object	0x0A	1	Status	4	BOOL	24(0)
Analogue Input status	Analog Input Point Object	0x0A	2	Status	4	BOOL	24(1)
Analogue Input status	Analog Input Point Object	0x0A	3	Status	4	BOOL	24(2)
Analogue Input status	Analog Input Point Object	0x0A	4	Status	4	BOOL	24(3)
Analogue Input status	Analog Input Point Object	0x0A	5	Status	4	BOOL	24(4)
Analogue Input status	Analog Input Point Object	0x0A	6	Status	4	BOOL	24(5)
Analogue Input status	Analog Input Point Object	0x0A	7	Status	4	BOOL	24(6)
Analogue Input status	Analog Input Point Object	0x0A	8	Status	4	BOOL	24(7)
Analogue Input status	Analog Input Point Object	0x0A	9	Status	4	BOOL	25(0)
Digital Input status	Discrete Input Point Object	0x08	1	Status	4	BOOL	25(1)
Digital Input status	Discrete Input Point Object	0x08	2	Status	4	BOOL	25(2)
Digital Input status	Discrete Input Point Object	0x08	3	Status	4	BOOL	25(3)
Digital Input status	Discrete Input Point Object	0x08	4	Status	4	BOOL	25(4)
Digital Input status	Discrete Input Point Object	0x08	5	Status	4	BOOL	25(5)
Digital Input status	Discrete Input Point Object	0x08	6	Status	4	BOOL	25(6)
Digital Input status	Discrete Input Point Object	0x08	7	Status	4	BOOL	25(7)
Digital Input status	Discrete Input Point Object	0x08	8	Status	4	BOOL	26(0)
Digital Input status	Discrete Input Point Object	0x08	9	Status	4	BOOL	26(1)
Digital Input status	Discrete Input Point Object	0x08	10	Status	4	BOOL	26(2)
Digital Input status	Discrete Input Point Object	0x08	11	Status	4	BOOL	26(3)
Digital Input status	Discrete Input Point Object	0x08	12	Status	4	BOOL	26(4)
Analogue Output status	Analog Output Point Object	0x0B	1	Status	4	BOOL	26(5)
Analogue Output status	Analog Output Point Object	0x0B	2	Status	4	BOOL	26(6)
Analogue Output status	Analog Output Point Object	0x0B	3	Status	4	BOOL	26(7)
Analogue Output status	Analog Output Point Object	0x0B	4	Status	4	BOOL	27(0)
Digital Output status	Discrete Output Point Object	0x09	1	Status	4	BOOL	27(1)
Digital Output status	Discrete Output Point Object	0x09	2	Status	4	BOOL	27(2)
Digital Output status	Discrete Output Point Object	0x09	3	Status	4	BOOL	27(3)
Digital Output status	Discrete Output Point Object	0x09	4	Status	4	BOOL	27(4)
Reserved bit						BOOL	27(5)
Reserved bit						BOOL	27(6)

Reserved bit						BOOL	27(7)

16.2.2 Assembly Instance 2

Data Size: 9 Bytes

I/O Assembly Data Attribute Mapping for Output Data

Component Name	Class		Instance No.	Attribute		Data Type	Bytes (bit)
	Name	No.		Name	No.		
Analogue Output	Analog Output Point Object	0x0B	1	Value	3	INT	0,1
Analogue Output	Analog Output Point Object	0x0B	2	Value	3	INT	2,3
Analogue Output	Analog Output Point Object	0x0B	3	Value	3	INT	4,5
Analogue Output	Analog Output Point Object	0x0B	4	Value	3	INT	6,7
Digital Output	Discrete Output Point Object	0x09	1	Value	3	BOOL	8(0)
Digital Output	Discrete Output Point Object	0x09	2	Value	3	BOOL	8(1)
Digital Output	Discrete Output Point Object	0x09	3	Value	3	BOOL	8(2)
Digital Output	Discrete Output Point Object	0x09	4	Value	3	BOOL	8(3)
Reserved bit (set to 0)						BOOL	8(4)
Reserved bit (set to 0)						BOOL	8(5)
Reserved bit (set to 0)						BOOL	8(6)
Reserved bit (set to 0)						BOOL	8(7)

16.2.3 Assembly Instance 3

Data Size: 21 Bytes

I/O Assembly Data Attribute Mapping for Status Data

Component Name	Class		Instance No.	Attribute		Data Type	Bytes (bit)
	Name	No.		Name	No.		
Node status	Identify Object	0x01	1	Node Status	100	LONG	0 to 3
Analogue Input Channel status	Analog Input Point Object	0x0A	1	Channel status	100	BYTE	4
Analogue Input Channel status	Analog Input Point Object	0x0A	2	Channel status	100	BYTE	5
Analogue Input Channel status	Analog Input Point Object	0x0A	3	Channel status	100	BYTE	6
Analogue Input Channel status	Analog Input Point Object	0x0A	4	Channel status	100	BYTE	7
Analogue Input Channel status	Analog Input Point Object	0x0A	5	Channel status	100	BYTE	8
Analogue Input Channel status	Analog Input Point Object	0x0A	6	Channel status	100	BYTE	9
Analogue Input Channel status	Analog Input Point Object	0x0A	7	Channel status	100	BYTE	10
Analogue Input Channel status	Analog Input Point Object	0x0A	8	Channel status	100	BYTE	11
Analogue Input Channel status	Analog Input Point Object	0x0A	9	Channel status	100	BYTE	12
Analogue Output Channel status	Analog Output Point Object	0x0B	1	Channel status	100	BYTE	13
Analogue Output Channel status	Analog Output Point Object	0x0B	2	Channel status	100	BYTE	14
Analogue Output Channel status	Analog Output Point Object	0x0B	3	Channel status	100	BYTE	15
Analogue Output Channel status	Analog Output Point Object	0x0B	4	Channel status	100	BYTE	16
Analogue Input status	Analog Input Point Object	0x0A	1	Status	4	BOOL	17(0)
Analogue Input status	Analog Input Point Object	0x0A	2	Status	4	BOOL	17(1)
Analogue Input status	Analog Input Point Object	0x0A	3	Status	4	BOOL	17(2)
Analogue Input status	Analog Input Point Object	0x0A	4	Status	4	BOOL	17(3)
Analogue Input status	Analog Input Point Object	0x0A	5	Status	4	BOOL	17(4)
Analogue Input status	Analog Input Point Object	0x0A	6	Status	4	BOOL	17(5)
Analogue Input status	Analog Input Point Object	0x0A	7	Status	4	BOOL	17(6)
Analogue Input status	Analog Input Point Object	0x0A	8	Status	4	BOOL	17(7)
Analogue Input status	Analog Input Point Object	0x0A	9	Status	4	BOOL	18(0)
Digital Input status	Discrete Input Point Object	0x08	1	Status	4	BOOL	18(1)
Digital Input status	Discrete Input Point Object	0x08	2	Status	4	BOOL	18(2)
Digital Input status	Discrete Input Point Object	0x08	3	Status	4	BOOL	18(3)
Digital Input status	Discrete Input Point Object	0x08	4	Status	4	BOOL	18(4)
Digital Input status	Discrete Input Point Object	0x08	5	Status	4	BOOL	18(5)
Digital Input status	Discrete Input Point Object	0x08	6	Status	4	BOOL	18(6)
Digital Input	Discrete Input Point Object	0x08	7	Status	4	BOOL	18(7)
Digital Input status	Discrete Input Point Object	0x08	8	Status	4	BOOL	19(0)
Digital Input status	Discrete Input Point Object	0x08	9	Status	4	BOOL	19(1)
Digital Input status	Discrete Input Point Object	0x08	10	Status	4	BOOL	19(2)
Digital Input status	Discrete Input Point Object	0x08	11	Status	4	BOOL	19(3)
Digital Input status	Discrete Input Point Object	0x08	12	Status	4	BOOL	19(4)
Analogue Output status	Analog Output Point Object	0x0B	1	Status	4	BOOL	19(5)
Analogue Output status	Analog Output Point Object	0x0B	2	Status	4	BOOL	19(6)
Analogue Output status	Analog Output Point Object	0x0B	3	Status	4	BOOL	19(7)
Analogue Output status	Analog Output Point Object	0x0B	4	Status	4	BOOL	20(0)
Digital Output status	Discrete Output Point Object	0x09	1	Status	4	BOOL	20(1)
Digital Output status	Discrete Output Point Object	0x09	2	Status	4	BOOL	20(2)
Digital Output status	Discrete Output Point Object	0x09	3	Status	4	BOOL	20(3)
Digital Output status	Discrete Output Point Object	0x09	4	Status	4	BOOL	20(4)
Reserved bit						BOOL	20(5)
Reserved bit						BOOL	20(6)

Reserved bit						BOOL	20(7)

16.3 Data Transmission Between DeviceNet Master and ICENI/MA-03

16.3.1 Connection Instance 2 – Poll

Master Poll request message: contains assembly instance 2 *Data*
(for data format see 16.2.2 - Assembly Instance 2)

ICENI/MA-03 response message: contains assembly instance 1 *Data*
(for data format see 16.2.1 - Assembly Instance 1)

16.3.2 Connection Instance 4 – COS/Cyclic

Master COS/Cyclic message: contains assembly instance 2 *Data*
(for data format see 16.2.2 - Assembly Instance 2)

ICENI/MA-03 COS/Cyclic message: contains assembly instance 1 *Data*
(for data format see 16.2.1 - Assembly Instance 1)

16.3.3 Connection Instance 3 – Bit-Strobe

Master Bit-Strobe message: no data
ICENI/MA-03 COS/Cyclic message: contains Identity instance 1 attribute 100
Node Status (4 bytes data format as table below)

Bits	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Description	Heartbeat	All bits Reserved							Number of modules in the node					All bits Reserved		
Value	0 or 1	0	0	0	0	0	0	0	0-16					0	0	0

Continue 1

Bits	16	17	18	19	20	21	22	23
Description	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module 8
Value	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

Continue 2

Bits	24	25	26	27	28	29	30	31
Description	Module 9	Module 10	Module 11	Module 12	Module 13	Module 14	Module 15	Module 16
Value	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

16.3.4 Connection Instance 5 – Multi Poll

Master Multi Poll request message: no data

ICENI/MA-03 response message: contains assembly instance 3 *Data*
(for data format see 16.2.3 - Assembly Instance 3)

17 SOFTWARE VERSION

This instruction manual is valid for the following releases of software:

K0012/003
K0018/003

18 CONTACT

For sales or support enquiries, the following contact details should be used. The product part number and serial number (where available) should be referenced.

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19 REVISION HISTORY

REVISION	DATE	AUTHOR	CHANGES
1	20.07.20	MMB & XZ	Original

Regulateurs Europa Ltd
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CO1 2NX