Instruction Manual

ICENI/MA-02
CANopen Master Module

Pub_3639 - 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:

master module   signal conditioning modules (x8 in this example)   power supply module
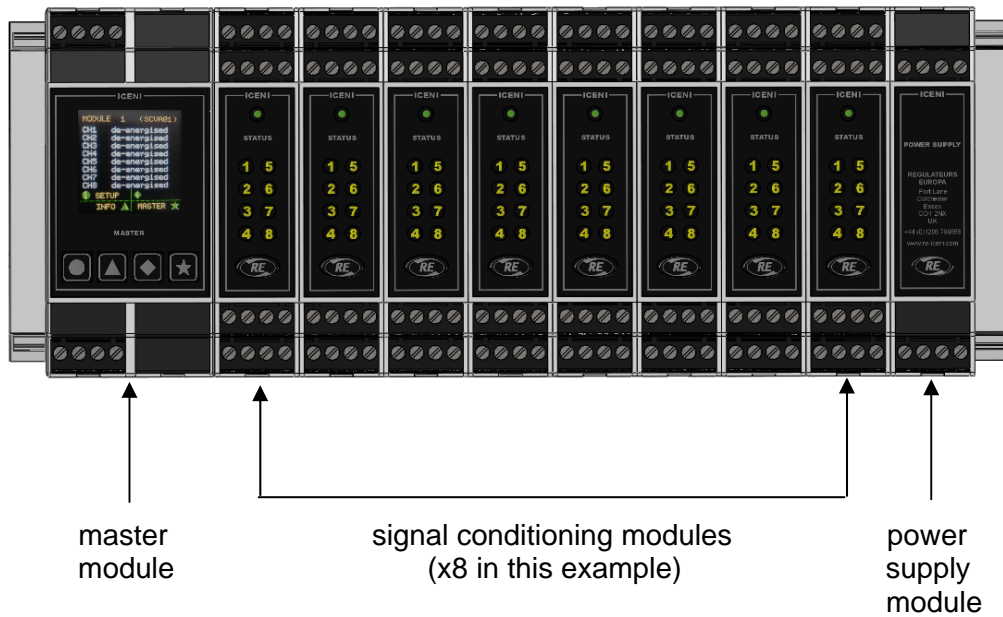
According to the mix of signal conditioning modules, the Iceni node manages the measurement and generation of electrical signals to/from sensors and field devices. Information is exchanged with other nodes in a system via a field communications network connected to the Iceni master module.
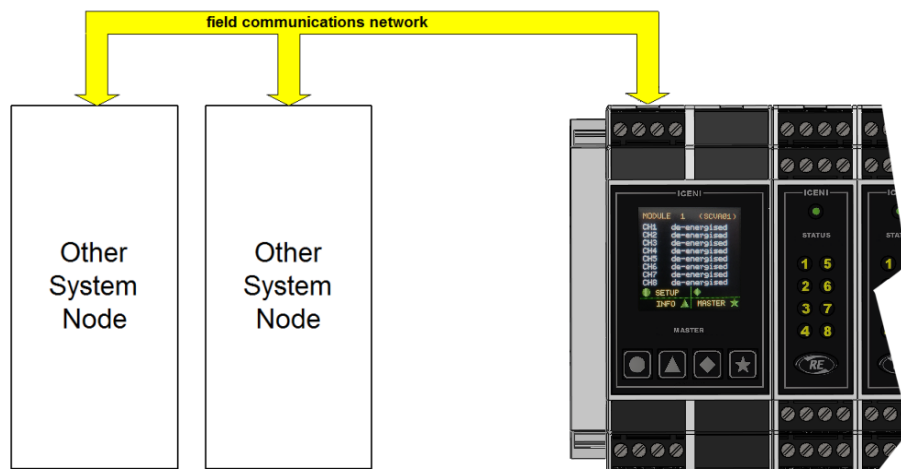
3.2   ICENIbus Interface

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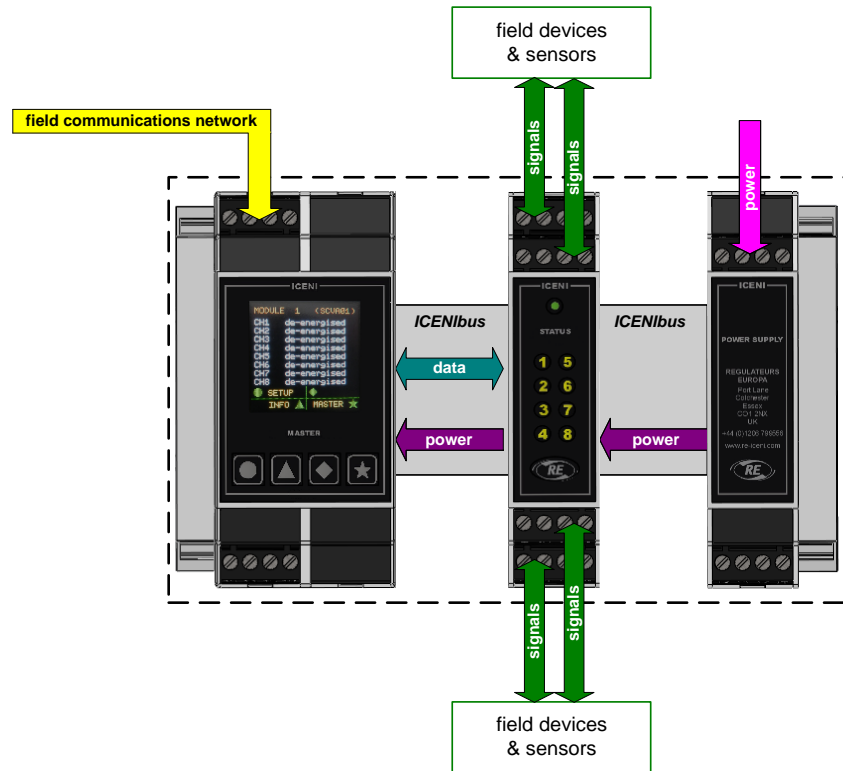
All modules have a 10-way ICENIbus connector on both sides of the lower housing, although for end modules (master and main power supply) one side connector will be supplied fitted with a protective cover.
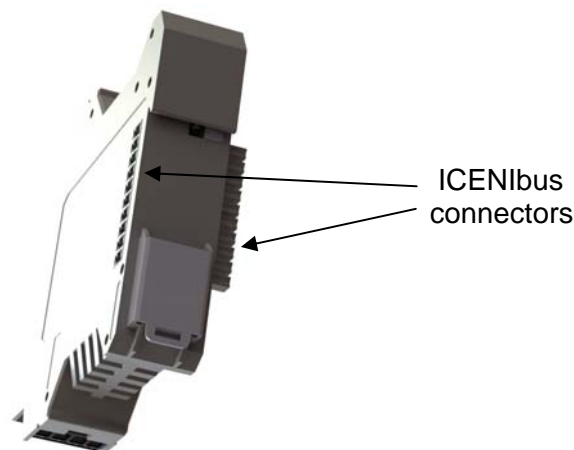
3.3   Field Wiring Interface

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

For ICENI/MA-02 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-02 KEY FEATURES

The ICENI/MA-02 module is a component of an Iceni node and provides a slave interface to a CANopen field communications network and coordinates data flow between Iceni modules within a node.

The ICENI/MA-02 module also provides an access point for configuration and status display via the in-built User Interface

The ICENI/MA-02 module provides the following key features:

o Data access to/from up to sixteen signal conditioning modules, each with a maximum of eight I/O channels.

o CANopen (slave) field communications interface for communication of data to a remote station.

o Node health status indication via changeover relay contacts.

o Colour graphic display and keypad for Iceni node and signal channel configuration and access to channel measured, driven and status information.

o 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

CANopen: slave

Supported CiA standards: draft 301 (v4.2) & draft 401 (v3.0)

Baudrate: 20k, 50k, 125k, 150k, 250k,
                                       500k, 800k, 1M

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

CANopen interface to ICENIbus :   1kV

CANopen 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)
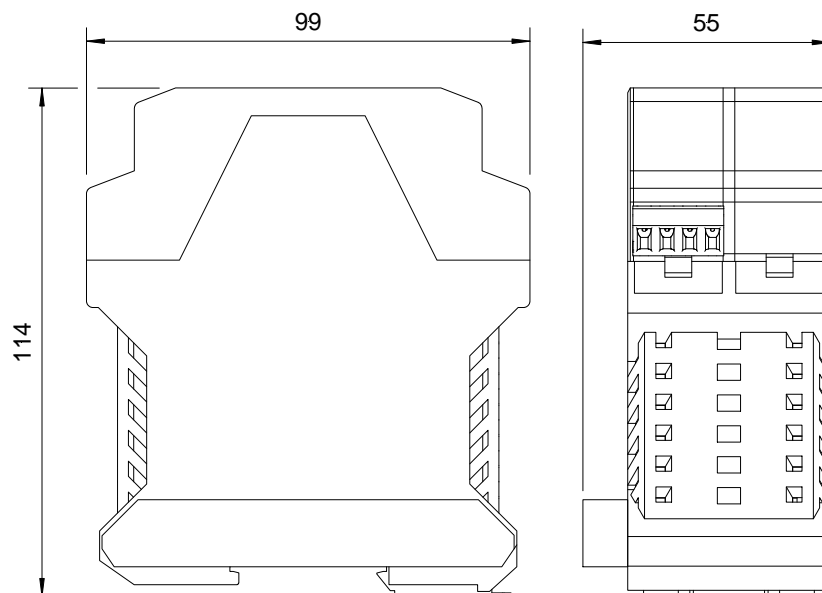
6   UNPACKING & INITIAL PREPARATION FOR USE

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.

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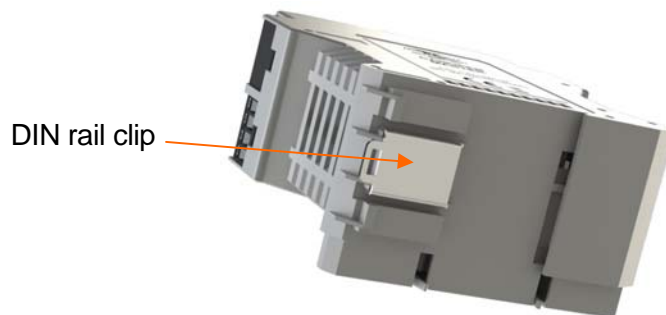
An Iceni node can be mounted in both vertical and horizontal orientations according to terminal rail layout. Assembly of the Iceni node can be achieved in one of two ways:

o   The Iceni node (including the ICENI/MA-02 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.

o   The ICENI/MA-02 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:

o 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.

o 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-02 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
CANopen 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
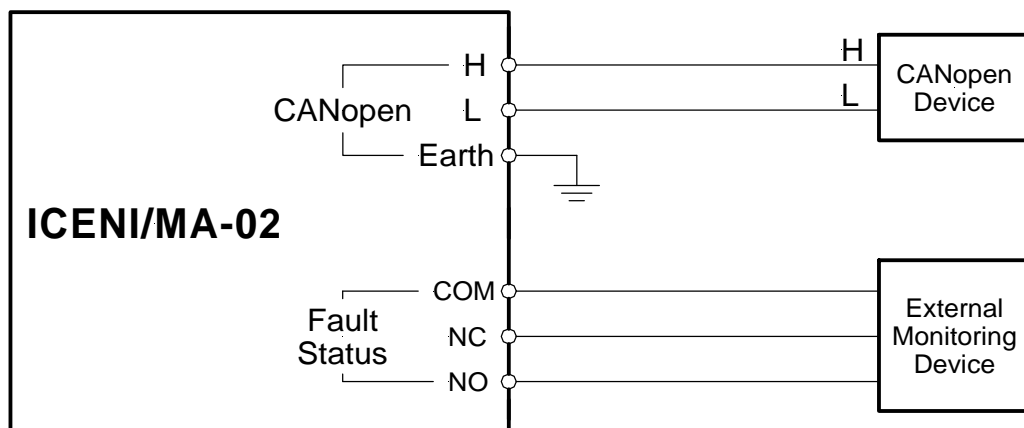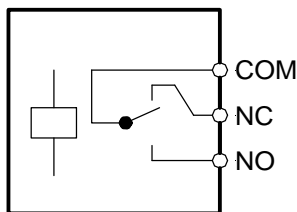
7.3 Earthing / Grounding

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 CANopen 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 CANopen Network Termination

If the Iceni node is at one end of a CANopen network, a 120R termination resistor should be fitted directly across the CANopen H and L terminals at the ICENI/MA-02 module.

8   MODULE OPERATION

8.1   Module Configuration

When the ICENI/MA-02 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-02 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-02 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):

1   2   3   4   5   6   7   8   9   10 11 12 13 14 15 16
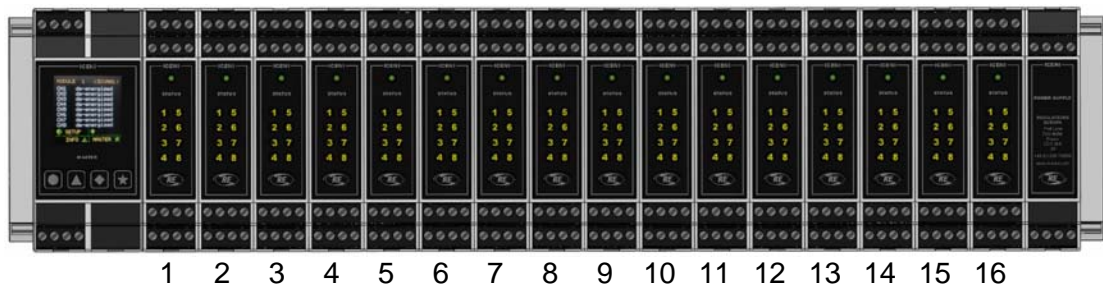
The sequence of module numbers will be continuous i.e. if four modules are fitted then they will always take the module numbers 1, 2, 3, and 4, etc.

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

At the end of the Iceni node configuration process, the ICENI/MA-02 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:

o   Power loss to Iceni node

o   Node configuration in progress

o   Failure of any Iceni signal conditioning module

9 DATA COMMUNICATIONS TO SIGNAL CONDITIONING MODULES

9.1 Process Image

9.1.1 Node Process Image

The ICENI/MA-02 module communicates node data to field equipment via the CANopen field communication network. The CANopen protocol within the ICENI/MA-02 exchanges data with signal conditioning modules via a node process image.

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

MEASURED OR DRIVEN SIGNAL VALUES		SIGNAL STATUS VALUES	
	SIGNAL CONDITIONING MODULE 1		SIGNAL CONDITIONING MODULE 1
	SIGNAL CONDITIONING MODULE 2 (if available)		SIGNAL CONDITIONING MODULE 2 (if available)
	SIGNAL CONDITIONING MODULE 3 (if available)		SIGNAL CONDITIONING MODULE 3 (if available)
	SIGNAL CONDITIONING MODULE 4 (if available)		SIGNAL CONDITIONING MODULE 4 (if available)
	SIGNAL CONDITIONING MODULE 5 (if available)		SIGNAL CONDITIONING MODULE 5 (if available)
	SIGNAL CONDITIONING MODULE 6 (if available)		SIGNAL CONDITIONING MODULE 6 (if available)
	SIGNAL CONDITIONING MODULE 7 (if available)		SIGNAL CONDITIONING MODULE 7 (if available)
	SIGNAL CONDITIONING MODULE 8 (if available)		SIGNAL CONDITIONING MODULE 8 (if available)
	SIGNAL CONDITIONING MODULE 9 (if available)		SIGNAL CONDITIONING MODULE 9 (if available)
	SIGNAL CONDITIONING MODULE 10 (if available)		SIGNAL CONDITIONING MODULE 10 (if available)
	SIGNAL CONDITIONING MODULE 11 (if available)		SIGNAL CONDITIONING MODULE 11 (if available)
	SIGNAL CONDITIONING MODULE 12 (if available)		SIGNAL CONDITIONING MODULE 12 (if available)
	SIGNAL CONDITIONING MODULE 13 (if available)		SIGNAL CONDITIONING MODULE 13 (if available)
	SIGNAL CONDITIONING MODULE 14 (if available)		SIGNAL CONDITIONING MODULE 14 (if available)
	SIGNAL CONDITIONING MODULE 15 (if available)		SIGNAL CONDITIONING MODULE 15 (if available)
	SIGNAL CONDITIONING MODULE 16 (if available)		SIGNAL CONDITIONING MODULE 16 (if available)

9.1.2 Signal Conditioning Module Process Image

Following configuration of the Iceni node, the ICENI/MA-02 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-02 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 STATUS VALUES	SIGNAL CHANNEL 1 (if available)
	SIGNAL CHANNEL 2 (if available)			SIGNAL CHANNEL 2 (if available)
	SIGNAL CHANNEL 3 (if available)			SIGNAL CHANNEL 3 (if available)
	SIGNAL CHANNEL 4 (if available)			SIGNAL CHANNEL 4 (if available)
	SIGNAL CHANNEL 5 (if available)			SIGNAL CHANNEL 5 (if available)
	SIGNAL CHANNEL 6 (if available)			SIGNAL CHANNEL 6 (if available)
	SIGNAL CHANNEL 7 (if available)			SIGNAL CHANNEL 7 (if available)
	SIGNAL CHANNEL 8 (if available)			SIGNAL CHANNEL 8 (if available)

9.2 Data Format

9.2.1 Signal Inputs

Analogue Values

Analogue signal input values are presented on the field network in 'real world' format, i.e. a temperature measurement will be presented as a temperature value; a voltage measurement will be presented as a voltage value, etc.

The format for each type of signal will vary – refer to the specific signal conditioning module instruction manual for details.

Digital Values

Digital signal input values are presented on the field network as both analogue and bitmapped values (see section 'CANopen Field Communications Network').

9.2.2   Signal Output Values

Analogue Values

Analogue signal output values are written to the Iceni node in 'real world' format, i.e. a voltage output will be written as a voltage value; a current signal will be written as a current value, etc.

The format for each type of signal will vary – refer to the specific signal conditioning module instruction manual for details.

Digital Values

Digital signal output values are presented on the field network as both analogue and bitmapped values (see section 'CANopen Field Communications Network').

9.2.3   Signal Status Values

Each signal channel has a status value associated with it representing the operating condition of the channel. Typically this could be operating states such as 'healthy', 'open circuit' or 'short circuit'.

For normal healthy operation, the signal channel status will hold a value of 0x00.

If a signal channel is not present (e.g. channel 8 of a four channel module) then the signal channel status will hold a value of 0x07.

If the ICENI/MA-02 cannot successfully communicate with a signal conditioning module (e.g. the signal conditioning module has failed) then the signal channel status will hold a value of 0x08.

Other signal channel status values are described in detail in the specific signal conditioning module instruction manual.

10   MODULE USER INTERFACE

10.1   Physical Interface

The ICENI/MA-02 provides a colour dot matrix display to allow status information to be viewed, and configuration of module parameters.
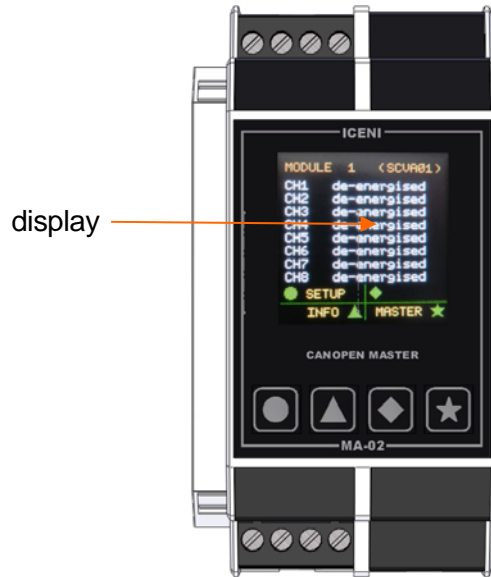
display

10.2   Keypad

The ICENI/MA-02 also provides a four button keypad to allow display screen navigation and configuration of module parameters.

pushbuttons
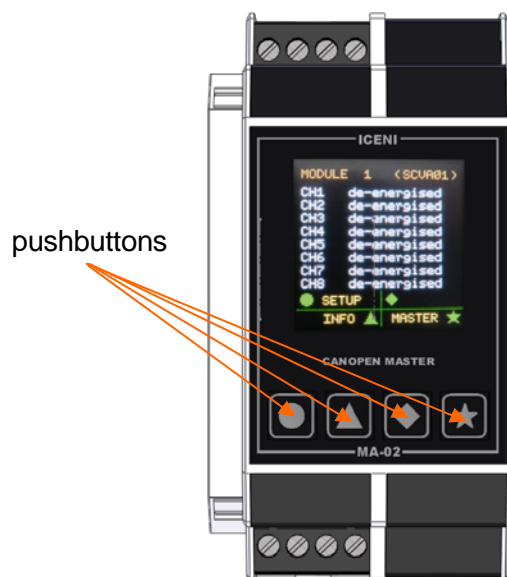
10.3 Display Screen Format

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-02)

Module ID

Screen Reference

Main Area

Pushbutton Actions
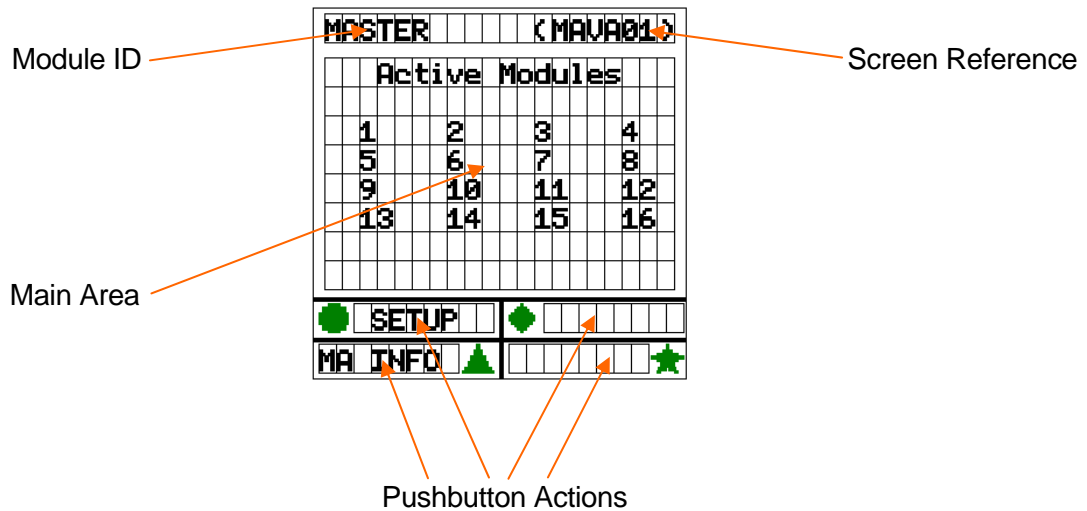
10.3.1 Module ID

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-02 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-02, 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-02)
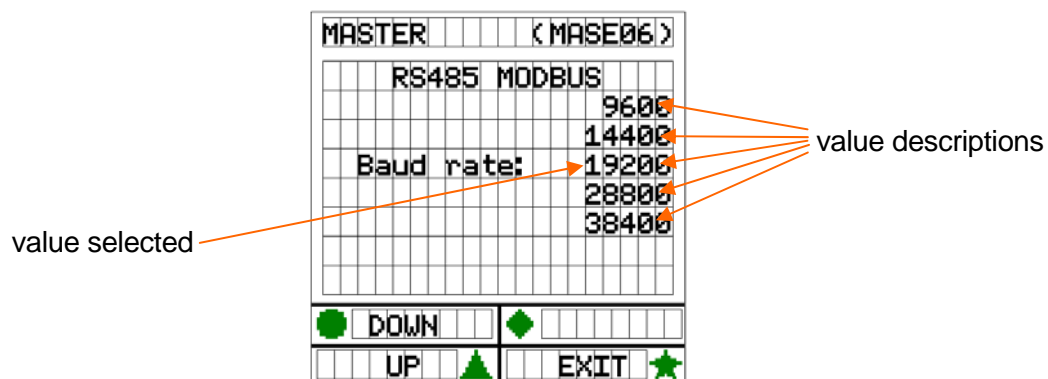
The selected value description is the one in line with the 'Baud Rate' text and is highlighted the same colour. All other value options are highlighted in yellow.

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-02)
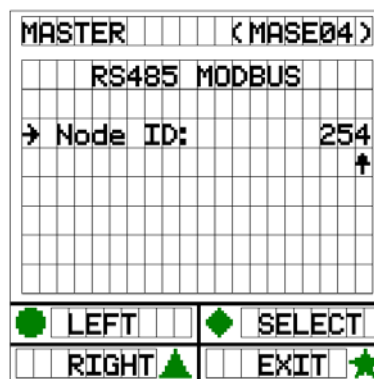
The numerical parameter will have a number of characters making up the value, i.e. if the maximum value held is 254 then there will be three characters for the parameter.

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-02)

```
MASTER      (MASE05)
      RS485 MODBUS

→ Node ID:        254
                    ↑




   ● DEC     ◆
      INC  ▲  FINISH ★
```
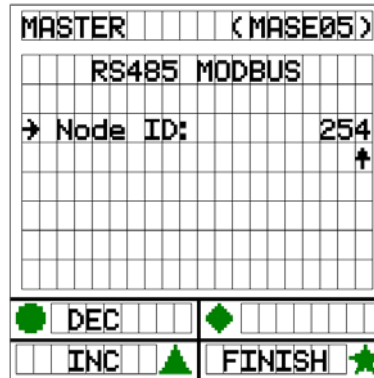
Using the 'dec' or 'inc' pushbuttons, the character numerical value can be nudged down or up one increment where the increment is equal to the character position. i.e. if the selection cursor is in the 'tens' column then when 'inc' pushbutton is pressed, the value will be increased by 10.

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-02 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-02 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-02 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-02 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]
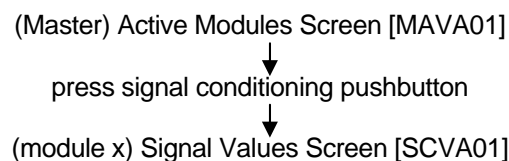
The ICENI/MA-02 will display channel values for each of the module channels that are provided.

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]
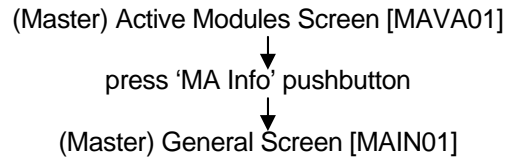
o   'Alarm O/P':   if a signal conditioning module has failed, or no
                                        modules have been discovered during configuration
                                        then this parameter will show 'fault' otherwise the
                                        system is healthy and will show 'healthy'

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]
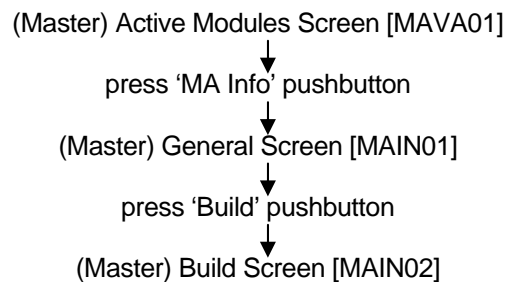
o   Screen title   description of the master module

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 (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]
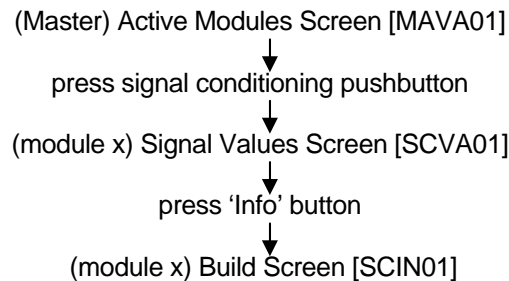
- o   Screen title   a description of the signal conditioning module

- 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-02 provides the functionality to adjust and configure parameters.

12.1 ICENI/MA-02 Isolation During Configuration

During configuration and storage of any parameters, the ICENI/MA-02 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-02 has completed setup mode. The CANopen 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) Internal / External Params Screen [MASE01]
↓
press 'Internal' 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]
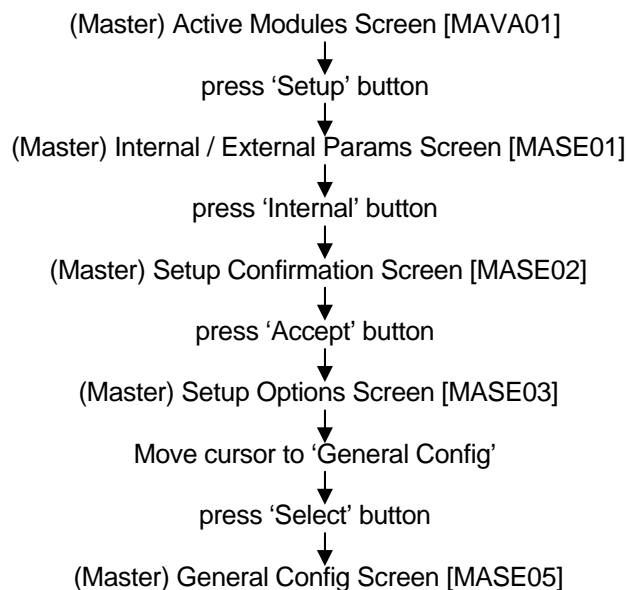
12.2.1 Temperature Unit (^{o}C / ^{o}F) Configuration

The parameter 'Temperature as' selects the temperature unit to be used (Celsius or Fahrenheit) and can be configured as ^{o}C or ^{o}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 CANopen Interface General Parameters

A number of CANopen 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) Internal / External Params Screen [MASE01]

↓

press 'Internal' button

↓

(Master) Setup Confirmation Screen [MASE02]

↓

press 'Accept' button

↓

(Master) Setup Options Screen [MASE03]

Move cursor to 'CANOpen interface'

↓

press 'Select' button

↓

(Master) CANOpen Interface Screen [MASE07]

↓

Move cursor to 'CANOpen General'

↓

press 'Select' button

↓

(Master) CANOpen General Screen [MASE08]

12.3.1 CANopen Node ID Configuration

The CANopen node identity can be configured using the parameter 'Node ID'. (Edit is numerical).

12.3.2 CANopen 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 CANopen Heartbeat Configuration

The CANopen 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 CANopen Channel/Module Status Mapping Configuration

The channel / module / node status information can be mapped to TPDO via selection of menu item 'Extended Mode'. (Edit is by selection from a list.)

If 'y' is selected by 'Extended Mode', the max value of node ID will be limited to 13 and channel / module / node status information will be mapped to TPDO. In this case, the channel / module / node status info will be transmitted via TPDO every half second if the node enters Operational Mode (by default, the transmission type of those status TPDOs is set to time triggered and the time is set to half second).

If 'n' is selected by 'Extended Mode', the max value of node ID will be limited to 15 and channel / module / node status information will not be mapped to TPDO. But the channel / module / node status information can still be obtained via reading manufacturer specific entries (see section 14.8.2).

12.4 Configuration of CANopen Channel Data Type Parameters

A number of CANopen channel data type 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) Internal / External Params Screen [MASE01]

↓

press 'Internal' button

↓

(Master) Setup Confirmation Screen [MASE02]

↓

press 'Accept' button

↓

(Master) Setup Options Screen [MASE03]

↓

Move cursor to 'CANopen interface'

↓

press 'Select' button

↓

(Master) CANopen Interface Screen [MASE07]

↓

Move cursor to 'Channel Data Type'

↓

press 'Select' button

↓

(Master) Channel Data Type Screen [MASE15]
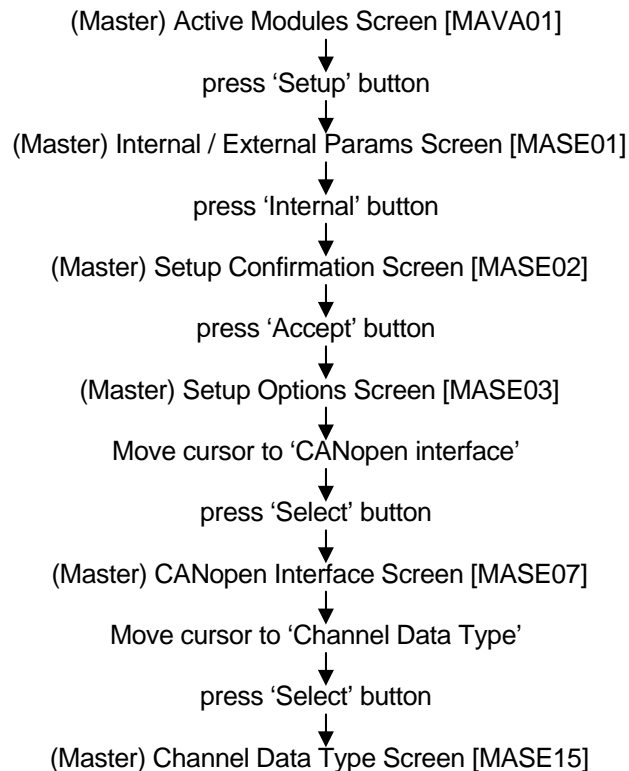
12.4.1 CANopen Input Data Configuration

The CANopen data format for input channels can be configured using the parameter 'I/P data'' and selecting 'analogue' or 'digital'. (Edit is by selection from a list.)

The option 'digital' will only be presented if all signal input channels are digital. If any signal input channels are analogue then only the option 'analogue' will be presented.

12.4.2 CANopen Output Data Configuration

The CANopen data format for output channels can be configured using the parameter 'O/P data'' and selecting 'analogue' or 'digital'. (Edit is by selection from a list.)

The option 'digital' will only be presented if all signal output channels are digital. If any signal output channels are analogue then only the option 'analogue' will be presented.

12.5 Configuration of CANopen RPDO Data Exchange

A number of CANopen RPDO 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 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 'RPDO Configuration'

↓

press 'Select' button

↓

(module x) PDO Configuration Screen [SCSE05]
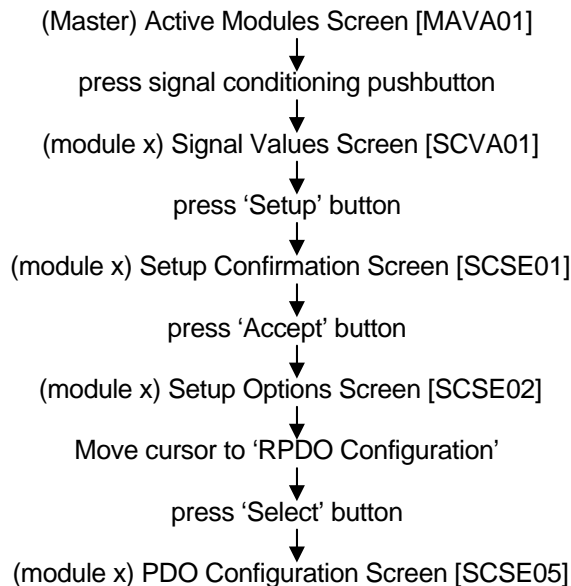
12.5.1 RPDO01 & RPDO02 Configuration

The CANopen RPDO01 and RPDO02 types can be configured using the parameters 'RPDO01' and 'RPDO02' and selecting 'sync' or 'async' for each. (Edit is by selection from a list.)

If the CANopen data format for outputs is configured as 'digital', and only digital output channels are present in the Iceni node, then parameter 'RPDO01' will be common for signal conditioning modules 1 to 8, and parameter 'RPDO02' will be common across for signal conditioning modules 9 to 16, otherwise parameters 'RPDO01' and 'RPDO02' will only apply to the signal conditioning module at which the pushbutton was first pressed.

12.6   Configuration of CANopen TPDO Data Exchange

A number of CANopen TPDO 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 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 'TPDO Configuration'

↓

press 'Select' button

↓

(module x) PDO Configuration Screen [SCSE08]
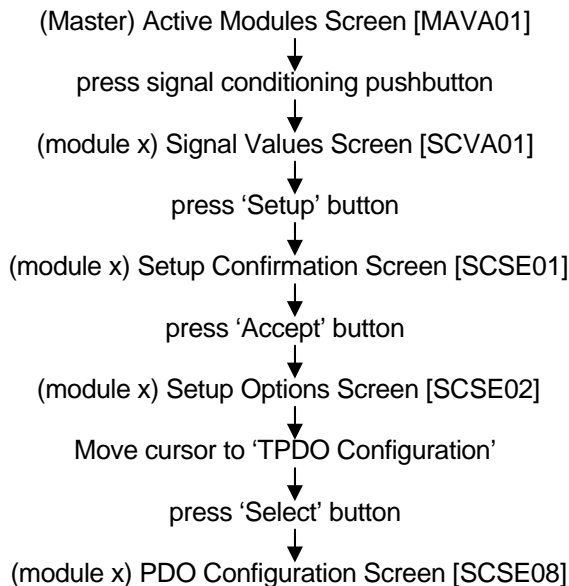
12.6.1 TPDO01 & TPDO02 Configuration

The CANOpen TPDO01 and TPDO02 types can be configured using the following parameters:

o   'T'PDO01'   can be set to 'timetrig', 'sync' or 'disabled'
                              (Edit is by selection from a list.)

If 'TPDO01='timetrig' then
o   'T'PDO01 (ms)'   TPDO01 delay in milliseconds
                              (Edit is numerical)

If 'TPDO01='sync' then
o   'T'PDO01 (ct)'   TPDO01 delay in number of counts
                              (Edit is numerical)

o   'T'PDO02'   can be set to 'timetrig', 'sync' or 'disabled'
                              (Edit is by selection from a list.)

If 'TPDO02='timetrig' then
o   'T'PDO02 (ms)'   TPDO02 delay in milliseconds
                              (Edit is numerical)

If 'TPDO02='sync' then
o   'T'PDO02 (ct)'   TPDO02 delay in number of counts
                              (Edit is numerical)

If the CANopen data format for inputs is configured as 'digital', and only digital input channels are present in the Iceni node, then parameter 'TPDO01' will be common for signal conditioning modules 1 to 8, and parameter 'TPDO02' will be common across for signal conditioning modules 9 to 16, otherwise parameters 'TPDO01' and 'TPDO02' will only apply to the signal conditioning module at which the pushbutton was first pressed.

12.7   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]
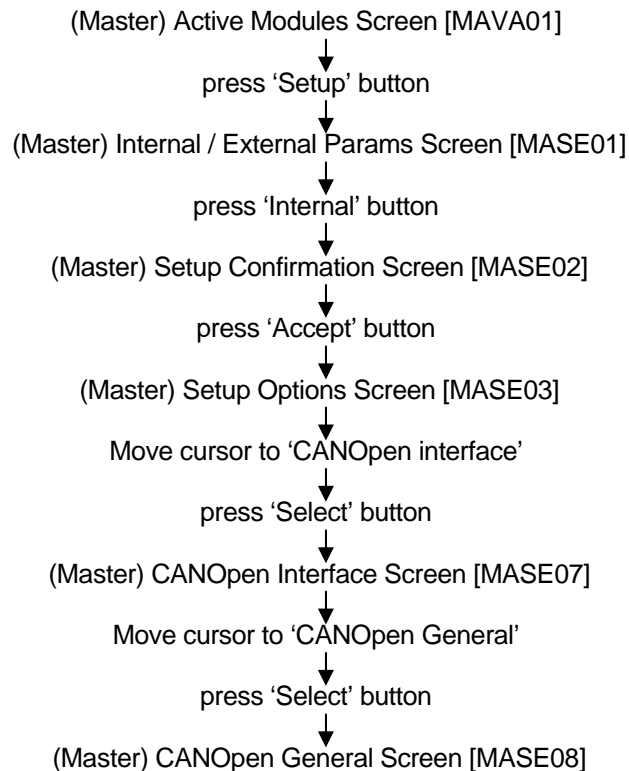
press signal conditioning pushbutton

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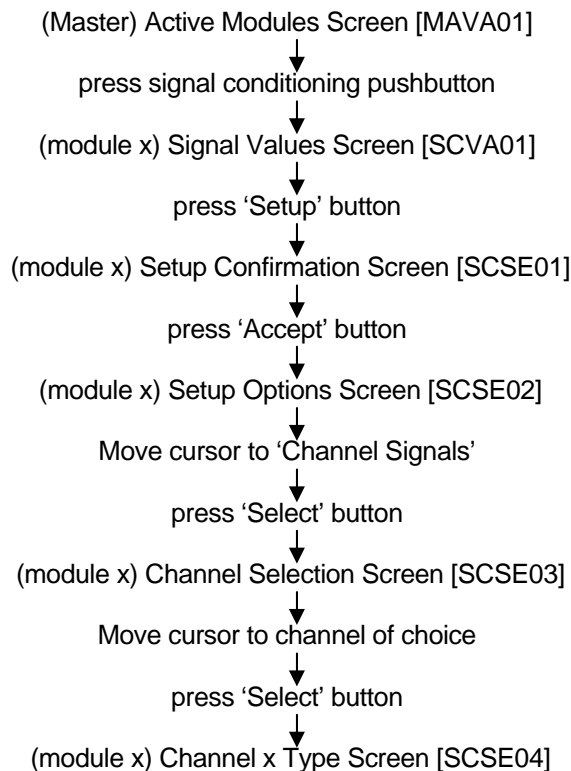
The screen will present the various signal type options for the specific signal channel that can be configured. (Edit is by selection from a list.)

13   PARAMETER STORAGE

The user interface in the ICENI/MA-02 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 Storage of Externally configured Parameters

A number of CANopen parameters are externally configurable via the CANopen network itself. However, unless the parameters are saved to EEPROM memory following configuration, any edited values will be lost at power down.

In order to store the parameters the following sequence should be followed:
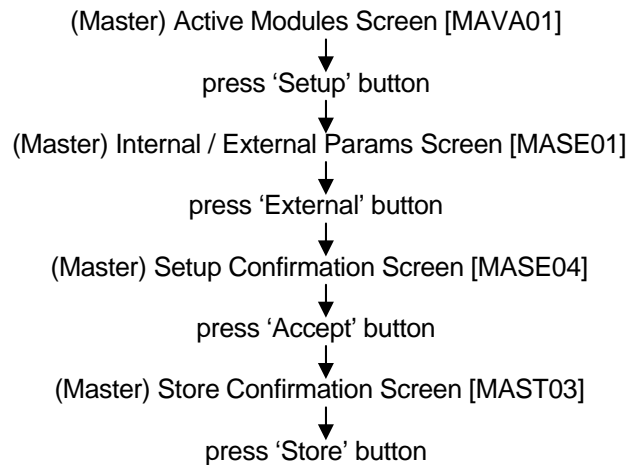
(Master) Active Modules Screen [MAVA01]

↓

press 'Setup' button

↓

(Master) Internal / External Params Screen [MASE01]

↓

press 'External' button

↓

(Master) Setup Confirmation Screen [MASE04]

↓

press 'Accept' button

↓

(Master) Store Confirmation Screen [MAST03]

↓

press 'Store' button

Parameter storage to EEPROM will commence (if 'store' was selected) and once complete, the display will return to (Master) Active Modules Screen [MAIN01]. See Section 15 for the parameters list that can be saved if 'store' was selected.

14 CANOPEN FIELD COMMUNICATIONS NETWORK

14.1 ICENI/MA-02 Functionality

The ICENI/MA-02 module is compliant with the CiA Draft Standard Proposal 301 version 4.2, and the CiA Draft Standard 401 version 3.0.

It includes the following functions:

o PDO triggering can be 'Time Driven' or 'Synchronized'

o Static PDO mapping with configuration using the User Interface and selection for all input and output channels

o PDO linking

o SDO server

o Heartbeat

o Emergency message

o SYNC producer / consumer

14.2 Operation After Power Up / Reset / Configuration

At power up, the ICENI/MA-02 master module will enter pre-operational mode by default if 'Disable' is selected via parameter 'Selfstart' in menu CANopen interface > CANopen General. In this mode, only the heartbeat (if enabled via the User Interface) and SDO messages can be transmitted or received. To transmit or receive PDO messages, ICENI/MA-02 needs to be in the Operational mode.

The ICENI/MA-02 master module supports NMT communication. After power up reset, or configuration, the ICENI/MA-02 master module will enter pre-operational mode if 'Disable' is selected via parameter 'Selfstart', and the module will wait for the NMT Master message in order to enter Operational mode.

If 'Enable' is selected via parameter 'Selfstart', the ICENI/MA-02 master module will enter Operational mode after power up, reset, or configuration.

14.3 CAN IDs

The ICENI/MA-02 CANopen protocol supports up to 15 nodes in a network if selecting 'n' via menu item 'Extended Mode' or 13 nodes in a network if selecting 'y' via menu item 'Extended Mode'. Each node has a maximum of 16 analogue / digital modules, and each module has up to 8 channels.

The channel/module/node status information can be mapped to TPDO if selecting 'y' via menu item 'Extended Mode'. In this case, an additional 9 TPDOs are needed for each node.

14.3.1 CAN IDs Without Status

The following tables show CAN IDs for all messages if selecting 'n' via menu item 'Extended Mode'. 'Analogue' means using sixteen bits per channel and 'digital' means using one bit per channel.

IDENTITIES FOR TRANSMISSION		
CAN ID		**Comment**
From	**To**	
0x80	--	SYNC Message for SYNC producer
0x81	0x8F	Emergency Message of nodes 1 to 15 (0x81 for node 1, 0x82 for node 2, ….)
0x181	0x18F	TPDO01 of nodes 1 to 15 for analogue inputs 1-4[2] of module **1** or all digital inputs of module **1-8**[3]
0x281	0x28F	TPDO02 of nodes 1 to 15 for analogue inputs 5-8[4] of module **1** or all digital inputs of module **9-16**[5]
0x381	0x38F	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **2**. 0x381 for node 1; 0x382 for node 2; ….
0x481	0x48F	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **2**. 0x481 for node 1; 0x482 for node 2; ….
0x191	0x19F	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **3**. 0x191 for node 1; 0x192 for node 2; ….
0x1A1	0x1AF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **3**. 0x1A1 for node 1; 0x1A2 for node 2; ….
0x1B1	0x1BF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **4**. 0x1B1 for node 1; 0x1B2 for node 2; ….
0x1C1	0x1CF	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **4**. 0x1C1 for node 1; 0x1C2 for node 2; ….
0x1D1	0x1DF	TPDO02 of nodes 1 to 15 for analogue inputs 1-4 of module **5**. 0x1D1 for node 1; 0x1D2 for node 2; ….
0x1E1	0x1EF	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **5**. 0x1E1 for node 1; 0x1E2 for node 2; ….
0x1F1	0x1FF	TPDO02 of nodes 1 to 15 for analogue inputs 1-4 of module **6**. 0x1F1 for node 1; 0x1F2 for node 2; ….
0x291	0x29F	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **6**. 0x291 for node 1; 0x292 for node 2; ….
0x2A1	0x2AF	TPDO02 of nodes 1 to 15 for analogue inputs 1-4 of module **7**. 0x2A1 for node 1; 0x2A2 for node 2; ….
0x2B1	0x2BF	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **7**. 0x2B1 for node 1; 0x2B2 for node 2; ….
0x2C1	0x2CF	TPDO02 of nodes 1 to 15 for analogue inputs 1-4 of module **8**. 0x2C1 for node 1; 0x2C2 for node 2; ….
0x2D1	0x2DF	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **8**. 0x2D1 for node 1; 0x2D2 for node 2; ….
0x2E1	0x2EF	TPDO02 of nodes 1 to 15 for analogue inputs 1-4 of module **9**. 0x2E1 for node 1; 0x2E2 for node 2; ….
0x2F1	0x2FF	TPDO01 of nodes 1 to 15 for analogue inputs 5-8 of module **9**. 0x2F1 for node 1; 0x2F2 for node 2; ….
0x391	0x39F	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **10**. 0x391 for node 1; 0x392 for node 2; ….
0x3A1	0x3AF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **10**. 0x3A1 for node 1; 0x3A2 for node 2; ….
0x3B1	0x3BF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **11**. 0x3B1 for node 1; 0x3B2 for node 2; ….
0x3C1	0x3CF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **11**. 0x3C1 for node 1; 0x3C2 for node 2; ….
0x3D1	0x3DF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **12**. 0x3D1 for node 1; 0x3D2 for node 2; ….
0x3E1	0x3EF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **12**. 0x3E1 for node 1; 0x3E2 for node 2; ….
0x3F1	0x3FF	TPDO01 of nodes 1 to 15 for analogue inputs1-4 of module **13**. 0x3F1 for node 1; 0x3F2 for node 2; ….
0x491	0x49F	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **13**. 0x491 for node 1; 0x492 for node 2; ….
0x4A1	0x4AF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **14**. 0x4A1 for node 1; 0x4A2 for node 2; ….
0x4B1	0x4BF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **14**. 0x4B1 for node 1; 0x4B2 for node 2; ….
0x4C1	0x4CF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **15**. 0x4C1 for node 1; 0x4C2 for node 2; ….
0x4D1	0x4DF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **15**. 0x4D1 for node 1; 0x4D2 for node 2; ….
0x4E1	0x4EF	TPDO01 of nodes 1 to 15 for analogue inputs 1-4 of module **16**. 0x4E1 for node 1; 0x4E2 for node 2; ….
0x4F1	0x4FF	TPDO02 of nodes 1 to 15 for analogue inputs 5-8 of module **16**. 0x4F1 for node 1; 0x4F2 for node 2; ….

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[2] See section 14.5.1 Analogue Data Type
[3] See section 14.5.1 Digital Data Type
[4] See section 14.5.1 Analogue Data Type
[5] See section 14.5.1 Digital Data Type

CAN ID		Comment
IDENTITIES FOR TRANSMISSION (Continued)		
From	**To**	
0x581	0x58F	Transmit SDO for nodes 1 to 15
0x701	0x70F	NMT Error Control(NMT master message, heartbeat) for nodes 1 to 15

CAN ID		Comment
IDENTITIES FOR RECEPTION		
From	**To**	
0x00	--	NMT Service from NMT master
0x80	--	SYNC Message from SYNC producer
0x201	0x20F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4[6] of module **1** or all digital outputs of module **1-8**[7]
0x301	0x30F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8[8] of module **1** or all digital outputs of module **9-16**[9]
0x401	0x40F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **2**. 0x401 for node 1; 0x402 for node 2; ….
0x501	0x50F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **2**. 0x501 for node 1; 0x502 for node 2; ….
0x211	0x21F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **3**. 0x211 for node 1; 0x212 for node 2; ….
0x221	0x22F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **3**. 0x221 for node 1; 0x222 for node 2; ….
0x231	0x23F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **4**. 0x231 for node 1; 0x232 for node 2; ….
0x241	0x24F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **4**. 0x241 for node 1; 0x242 for node 2; ….
0x251	0x25F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **5**. 0x251 for node 1; 0x252 for node 2; ….
0x261	0x26F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **5**. 0x261 for node 1; 0x262 for node 2; ….
0x271	0x27F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **6**. 0x271 for node 1; 0x272 for node 2; ….
0x311	0x31F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **6**. 0x311 for node 1; 0x312 for node 2; ….
0x321	0x32F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **7**. 0x321 for node 1; 0x322 for node 2; ….
0x331	0x33F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **7**. 0x331 for node 1; 0x332 for node 2; ….
0x341	0x34F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **8**. 0x341 for node 1; 0x342 for node 2; ….
0x351	0x35F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **8**. 0x351 for node 1; 0x352 for node 2; ….
0x361	0x36F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **9**. 0x361 for node 1; 0x362 for node 2; ….
0x371	0x37F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **9**. 0x371 for node 1; 0x372 for node 2; ….
0x411	0x41F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **10**. 0x411 for node 1; 0x412 for node 2; ….
0x421	0x42F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **10**. 0x421 for node 1; 0x422 for node 2; ….
0x431	0x43F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **11**. 0x431 for node 1; 0x432 for node 2; ….
0x441	0x44F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **11**. 0x441 for node 1; 0x442 for node 2; ….
0x451	0x45F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **12**. 0x451 for node 1; 0x452 for node 2; ….
0x461	0x46F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **12**. 0x461 for node 1; 0x462 for node 2; ….
0x471	0x47F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **13**. 0x471 for node 1; 0x472 for node 2; ….
0x511	0x51F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **13**. 0x511 for node 1; 0x512 for node 2; ….
0x521	0x52F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **14**. 0x521 for node 1; 0x522 for node 2; ….
0x531	0x53F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **14**. 0x531 for node 1; 0x532 for node 2; ….
0x541	0x54F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **15**. 0x541 for node 1; 0x542 for node 2; ….
0x551	0x55F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **15**. 0x551 for node 1; 0x552 for node 2; ….
0x561	0x56F	RPDO01 from nodes 1 to 15 for analogue outputs 1-4 of module **16**. 0x561 for node 1; 0x562 for node 2; ….
0x571	0x57F	RPDO02 from nodes 1 to 15 for analogue outputs 5-8 of module **16**. 0x571 for node 1; 0x572 for node 2; ….
0x601	0x60F	Receive SDO for nodes 1 to 15
0x701	0x70F	NMT Error Control (NMT master message, heartbeat) from nodes 1 to 15

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[6] See section 14.6.1 Analogue Data Type
[7] See section 14.6.2 Digital Data Type
[8] See section 14.6.1 Analogue Data Type
[9] See section 14.6.2 Digital Data Type

14.3.2 CAN IDs With Status

The following table shows CAN IDs for all messages if selecting 'y' via menu item 'Extended Mode'. 'Analogue' means using sixteen bits per channel and 'digital' means using one bit per channel.

IDENTITIES FOR TRANSMISSION		
CAN ID		**Comment**
From	**To**	
0x80	--	SYNC Message for SYNC producer
0x81	0x8D	Emergency Message of nodes 1 to 13 (0x81 for node 1, 0x82 for node 2, ….)
0x181	0x18D	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **1** or all digital inputs of module **1-8**
0x281	0x28D	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **1** or all digital inputs of module **9-16**
0x381	0x38D	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **2**. 0x381 for node 1; 0x382 for node 2; ….
0x481	0x48D	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **2**. 0x481 for node 1; 0x482 for node 2; ….
0x191	0x19D	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **3**. 0x191 for node 1; 0x192 for node 2; ….
0x1A1	0x1AD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **3**. 0x1A1 for node 1; 0x1A2 for node 2; ….
0x1B1	0x1BD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **4**. 0x1B1 for node 1; 0x1B2 for node 2; ….
0x1C1	0x1CD	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **4**. 0x1C1 for node 1; 0x1C2 for node 2; ….
0x1D1	0x1DD	TPDO02 of nodes 1 to 13 for analogue inputs 1-4 of module **5**. 0x1D1 for node 1; 0x1D2 for node 2; ….
0x1E1	0x1ED	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **5**. 0x1E1 for node 1; 0x1E2 for node 2; ….
0x1F1	0x1FD	TPDO02 of nodes 1 to 13 for analogue inputs 1-4 of module **6**. 0x1F1 for node 1; 0x1F2 for node 2; ….
0x291	0x29D	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **6**. 0x291 for node 1; 0x292 for node 2; ….
0x2A1	0x2AD	TPDO02 of nodes 1 to 13 for analogue inputs 1-4 of module **7**. 0x2A1 for node 1; 0x2A2 for node 2; ….
0x2B1	0x2BD	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **7**. 0x2B1 for node 1; 0x2B2 for node 2; ….
0x2C1	0x2CD	TPDO02 of nodes 1 to 13 for analogue inputs 1-4 of module **8**. 0x2C1 for node 1; 0x2C2 for node 2; ….
0x2D1	0x2DD	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **8**. 0x2D1 for node 1; 0x2D2 for node 2; ….
0x2E1	0x2ED	TPDO02 of nodes 1 to 13 for analogue inputs 1-4 of module **9**. 0x2E1 for node 1; 0x2E2 for node 2; ….
0x2F1	0x2FD	TPDO01 of nodes 1 to 13 for analogue inputs 5-8 of module **9**. 0x2F1 for node 1; 0x2F2 for node 2; ….
0x391	0x39D	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **10**. 0x391 for node 1; 0x392 for node 2; ….
0x3A1	0x3AD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **10**. 0x3A1 for node 1; 0x3A2 for node 2; ….
0x3B1	0x3BD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **11**. 0x3B1 for node 1; 0x3B2 for node 2; ….
0x3C1	0x3CD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **11**. 0x3C1 for node 1; 0x3C2 for node 2; ….
0x3D1	0x3DD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **12**. 0x3D1 for node 1; 0x3D2 for node 2; ….
0x3E1	0x3ED	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **12**. 0x3E1 for node 1; 0x3E2 for node 2; ….
0x3F1	0x3FD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **13**. 0x3F1 for node 1; 0x3F2 for node 2; ….
0x491	0x49D	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **13**. 0x491 for node 1; 0x492 for node 2; ….
0x4A1	0x4AD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **14**. 0x4A1 for node 1; 0x4A2 for node 2; ….
0x4B1	0x4BD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **14**. 0x4B1 for node 1; 0x4B2 for node 2; ….
0x4C1	0x4CD	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **15**. 0x4C1 for node 1; 0x4C2 for node 2; ….
0x4D1	0x4DD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **15**. 0x4D1 for node 1; 0x4D2 for node 2; ….
0x4E1	0x4ED	TPDO01 of nodes 1 to 13 for analogue inputs 1-4 of module **16**. 0x4E1 for node 1; 0x4E2 for node 2; ….
0x4F1	0x4FD	TPDO02 of nodes 1 to 13 for analogue inputs 5-8 of module **16**. 0x4F1 for node 1; 0x4F2 for node 2; ….
0x18E	0x18E	Channel status TPDO1 of module **01** & **02** for node **01**
0x19E	0x19E	Channel status TPDO2 of module **03** & **04** for node **01**
0x1AE	0x1AE	Channel status TPDO3 of module **05** & **06** for node **01**
0x1BE	0x1BE	Channel status TPDO4 of module **07** & **08** for node **01**
0x1CE	0x1CE	Channel status TPDO5 of module **09** & **10** for node **01**
0x1DE	0x1DE	Channel status TPDO6 of module **11** & **12** for node **01**
0x1EE	0x1EE	Channel status TPDO7 of module **13** & **14** for node **01**
0x1FE	0x1FE	Channel status TPDO8 of module **15** & **16** for node **01**
0x20E	0x20E	Channel status TPDO1 of module **01** & **02** from node **02**
0x21E	0x21E	Channel status TPDO2 of module **03** & **04** from node **02**
0x22E	0x22E	Channel status TPDO3 of module **05** & **06** for node **02**
0x23E	0x23E	Channel status TPDO4 of module **07** & **08** for node **02**
0x24E	0x24E	Channel status TPDO5 of module **09** & **10** for node **02**
0x25E	0x25E	Channel status TPDO6 of module **11** & **12** for node **02**
0x26E	0x26E	Channel status TPDO7 of module **13** & **14** for node **02**
0x27E	0x27E	Channel status TPDO8 of module **15** & **16** for node **02**
0x28E	0x28E	Channel status TPDO1 of module **01** & **02** for node **03**
0x29E	0x29E	Channel status TPDO2 of module **03** & **04** for node **03**

CAN ID		Comment
From	From	
0x2AE	0x2AE	Channel status TPDO3 of module **05** & **06** for node **03**
0x2BE	0x2BE	Channel status TPDO4 of module **07** & **08** for node **03**
0x2CE	0x2CE	Channel status TPDO5 of module **09** & **10** for node **03**
0x2DE	0x2DE	Channel status TPDO6 of module **11** & **12** for node **03**
0x2EE	0x2EE	Channel status TPDO7 of module **13** & **14** for node **03**
0x2FE	0x2FE	Channel status TPDO8 of module **15** & **16** for node **03**
0x30E	0x30E	Channel status TPDO1 of module **01** & **02** for node **04**
0x31E	0x31E	Channel status TPDO2 of module **03** & **04** for node **04**
0x32E	0x32E	Channel status TPDO3 of module **05** & **06** for node **04**
0x33E	0x33E	Channel status TPDO4 of module **07** & **08** for node **04**
0x34E	0x34E	Channel status TPDO5 of module **09** & **10** for node **04**
0x35E	0x35E	Channel status TPDO6 of module **11** & **12** for node **04**
0x36E	0x36E	Channel status TPDO7 of module **13** & **14** for node **04**
0x37E	0x37E	Channel status TPDO8 of module **15** & **16** for node **04**
0x38E	0x38E	Channel status TPDO1 of module **01** & **02** for node **05**
0x39E	0x39E	Channel status TPDO2 of module **03** & **04** for node **05**
0x3AE	0x3AE	Channel status TPDO3 of module **05** & **06** for node **05**
0x3BE	0x3BE	Channel status TPDO4 of module **07** & **08** for node **05**
0x3CE	0x3CE	Channel status TPDO5 of module **09** & **10** for node **05**
0x3DE	0x3DE	Channel status TPDO6 of module **11** & **12** for node **05**
0x3EE	0x3EE	Channel status TPDO7 of module **13** & **14** for node **05**
0x3FE	0x3FE	Channel status TPDO8 of module **15** & **16** for node **05**
0x40E	0x40E	Channel status TPDO1 of module **01** & **02** for node **06**
0x41E	0x41E	Channel status TPDO2 of module **03** & **04** for node **06**
0x42E	0x42E	Channel status TPDO3 of module **05** & **06** for node **06**
0x43E	0x43E	Channel status TPDO4 of module **07** & **08** for node **06**
0x44E	0x44E	Channel status TPDO5 of module **09** & **10** for node **06**
0x45E	0x45E	Channel status TPDO6 of module **11** & **12** for node **06**
0x46E	0x46E	Channel status TPDO7 of module **13** & **14** for node **06**
0x47E	0x47E	Channel status TPDO8 of module **15** & **16** for node **06**
0x48E	0x48E	Channel status TPDO1 of module **01** & **02** for node **07**
0x49E	0x49E	Channel status TPDO2 of module **03** & **04** for node **07**
0x4AE	0x4AE	Channel status TPDO3 of module **05** & **06** for node **07**
0x4BE	0x4BE	Channel status TPDO4 of module **07** & **08** for node **07**
0x4CE	0x4CE	Channel status TPDO5 of module **09** & **10** for node **07**
0x4DE	0x4DE	Channel status TPDO6 of module **11** & **12** for node **07**
0x4EE	0x4EE	Channel status TPDO7 of module **13** & **14** for node **07**
0x4FE	0x4FE	Channel status TPDO8 of module **15** & **16** for node **07**
0x50E	0x50E	Channel status TPDO1 of module **01** & **02** for node **08**
0x51E	0x51E	Channel status TPDO2 of module **03** & **04** for node **08**
0x52E	0x52E	Channel status TPDO3 of module **05** & **06** for node **08**
0x53E	0x53E	Channel status TPDO4 of module **07** & **08** for node **08**
0x54E	0x54E	Channel status TPDO5 of module **09** & **10** for node **08**
0x55E	0x55E	Channel status TPDO6 of module **11** & **12** for node **08**
0x56E	0x56E	Channel status TPDO7 of module **13** & **14** from node **08**
0x57E	0x57E	Channel status TPDO8 of module **15** & **16** from node **08**
0x18F	0x18F	Channel status TPDO1 of module **01** & **02** from node **09**
0x19F	0x19F	Channel status TPDO2 of module **03** & **04** from node **09**
0x1AF	0x1AF	Channel status TPDO3 of module **05** & **06** for node **09**
0x1BF	0x1BF	Channel status TPDO4 of module **07** & **08** for node **09**
0x1CF	0x1CF	Channel status TPDO5 of module **09** & **10** for node **09**
0x1DF	0x1DF	Channel status TPDO6 of module **11** & **12** for node **09**
0x1EF	0x1EF	Channel status TPDO7 of module **13** & **14** for node **09**
0x1FF	0x1FF	Channel status TPDO8 of module **15** & **16** for node **09**
0x20F	0x20F	Channel status TPDO1 of module **01** & **02** for node **10**
0x21F	0x21F	Channel status TPDO2 of module **03** & **04** for node **10**
0x22F	0x22F	Channel status TPDO3 of module **05** & **06** for node **10**
0x23F	0x23F	Channel status TPDO4 of module **07** & **08** for node **10**
0x24F	0x24F	Channel status TPDO5 of module **09** & **10** for node **10**
0x25F	0x25F	Channel status TPDO6 of module **11** & **12** for node **10**
0x26F	0x26F	Channel status TPDO7 of module **13** & **14** for node **10**
0x27F	0x27F	Channel status TPDO8 of module **15** & **16** for node **10**

Table title: **IDENTITIES FOR TRANSMISSION (Continued)**

IDENTITIES FOR TRANSMISSION (Continued)		
CAN ID		**Comment**
From	**From**	
0x28F	0x28F	Channel status TPDO1 of module **01** & **02** for node **11**
0x29F	0x29F	Channel status TPDO2 of module **03** & **04** for node **11**
0x2AF	0x2AF	Channel status TPDO3 of module **05** & **06** for node **11**
0x2BF	0x2BF	Channel status TPDO4 of module **07** & **08** for node **11**
0x2CF	0x2CF	Channel status TPDO5 of module **09** & **10** for node **11**
0x2DF	0x2DF	Channel status TPDO6 of module **11** & **12** for node **11**
0x2EF	0x2EF	Channel status TPDO7 of module **13** & **14** for node **11**
0x2FF	0x2FF	Channel status TPDO8 of module **15** & **16** for node **11**
0x30F	0x30F	Channel status TPDO1 of module **01** & **02** for node **12**
0x31F	0x31F	Channel status TPDO2 of module **03** & **04** for node **12**
0x32F	0x32F	Channel status TPDO3 of module **05** & **06** for node **12**
0x33F	0x33F	Channel status TPDO4 of module **07** & **08** for node **12**
0x34F	0x34F	Channel status TPDO5 of module **09** & **10** for node **12**
0x35F	0x35F	Channel status TPDO6 of module **11** & **12** for node **12**
0x36F	0x36F	Channel status TPDO7 of module **13** & **14** for node **12**
0x37F	0x37F	Channel status TPDO8 of module **15** & **16** for node **12**
0x38F	0x38F	Channel status TPDO1 of module **01** & **02** for node **13**
0x39F	0x39F	Channel status TPDO2 of module **03** & **04** for node **13**
0x3AF	0x3AF	Channel status TPDO3 of module **05** & **06** for node **13**
0x3BF	0x3BF	Channel status TPDO4 of module **07** & **08** for node **13**
0x3CF	0x3CF	Channel status TPDO5 of module **09** & **10** for node **13**
0x3DF	0x3DF	Channel status TPDO6 of module **11** & **12** for node **13**
0x3EF	0x3EF	Channel status TPDO7 of module **13** & **14** for node **13**
0x3FF	0x3FF	Channel status TPDO8 of module **15** & **16** for node **13**
0x40F	0x40F	Node status TPDO9 for Node **01**
0x41F	0x41F	Node status TPDO9 for Node **02**
0x42F	0x42F	Node status TPDO9 for Node **03**
0x43F	0x43F	Node status TPDO9 for Node **04**
0x44F	0x44F	Node status TPDO9 for Node **05**
0x45F	0x45F	Node status TPDO9 for Node **06**
0x46F	0x46F	Node status TPDO9 for Node **07**
0x47F	0x47F	Node status TPDO9 for Node **08**
0x48F	0x48F	Node status TPDO9 for Node **09**
0x49F	0x49F	Node status TPDO9 for Node **10**
0x4AF	0x4AF	Node status TPDO9 for Node **11**
0x4BF	0x4BF	Node status TPDO9 for Node **12**
0x4CF	0x4CF	Node status TPDO9 for Node **13**
0x581	0x58D	Transmit SDO for nodes 1 to 13
0x701	0x70D	NMT Error Control(NMT master message, heartbeat) for nodes 1 to 15

IDENTITIES FOR RECEPTION		
CAN ID		**Comment**
From	**To**	
0x00	--	NMT Service from NMT master
0x80	--	SYNC Message from SYNC producer
0x201	0x20D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **1** or digital output 1-64 of module **1-8**
0x301	0x30D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **1** or digital output 65-128 of module **9-16**
0x401	0x40D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **2**. 0x401 for node 1; 0x402 for node 2; ….
0x501	0x50D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **2**. 0x501 for node 1; 0x502 for node 2; ….
0x211	0x21D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **3**. 0x211 for node 1; 0x212 for node 2; ….
0x221	0x22D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **3**. 0x221 for node 1; 0x222 for node 2; ….
0x231	0x23D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **4**. 0x231 for node 1; 0x232 for node 2; ….
0x241	0x24D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **4**. 0x241 for node 1; 0x242 for node 2; ….
0x251	0x25D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **5**. 0x251 for node 1; 0x252 for node 2; ….
0x261	0x26D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **5**. 0x261 for node 1; 0x262 for node 2; ….
0x271	0x27D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **6**. 0x271 for node 1; 0x272 for node 2; ….
0x311	0x31D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **6**. 0x311 for node 1; 0x312 for node 2; ….
0x321	0x32D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **7**. 0x321 for node 1; 0x322 for node 2; ….
0x331	0x33D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **7**. 0x331 for node 1; 0x332 for node 2; ….
0x341	0x34D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **8**. 0x341 for node 1; 0x342 for node 2; ….
0x351	0x35D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **8**. 0x351 for node 1; 0x352 for node 2; ….
0x361	0x36D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **9**. 0x361 for node 1; 0x362 for node 2; ….
0x371	0x37D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **9**. 0x371 for node 1; 0x372 for node 2; ….
0x411	0x41D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **10**. 0x411 for node 1; 0x412 for node 2; ….
0x421	0x42D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **10**. 0x421 for node 1; 0x422 for node 2; ….
0x431	0x43D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **11**. 0x431 for node 1; 0x432 for node 2; ….
0x441	0x44D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **11**. 0x441 for node 1; 0x442 for node 2; ….
0x451	0x45D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **12**. 0x451 for node 1; 0x452 for node 2; ….
0x461	0x46D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **12**. 0x461 for node 1; 0x462 for node 2; ….
0x471	0x47D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **13**. 0x471 for node 1; 0x472 for node 2; ….
0x511	0x51D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **13**. 0x511 for node 1; 0x512 for node 2; ….
0x521	0x52D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **14**. 0x521 for node 1; 0x522 for node 2; ….
0x531	0x53D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **14**. 0x531 for node 1; 0x532 for node 2; ….
0x541	0x54D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **15**. 0x541 for node 1; 0x542 for node 2; ….
0x551	0x55D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **15**. 0x551 for node 1; 0x552 for node 2; ….
0x561	0x56D	RPDO01 from nodes 1 to 13 for analogue outputs 1-4 of module **16**. 0x561 for node 1; 0x562 for node 2; ….
0x571	0x57D	RPDO02 from nodes 1 to 13 for analogue outputs 5-8 of module **16**. 0x571 for node 1; 0x572 for node 2; ….
0x601	0x60D	Receive SDO for nodes 1 to 13
0x701	0x70F	NMT Error Control (NMT master message, heartbeat) from nodes 1 to 15

14.4   Support Transmission type

14.4.1 Support Transmission Type For Input Channels Value And All Channels Status (TPDO)

TPDO TRANSMISSION TYPE	
Transmission Type	**Description**
1 to 240	Synchronous Transmitted after every nth SYNC Object within the Synchronous Window Length, where n is the transmission type. For example, when using transmission type 34, the PDO is transmitted after every 34th SYNC Object.
254	Time triggered Transmitted at a regular frequency.

14.4.2 Support Transmission Type For Output Channels Value RPDO

RPDO TRANSMISSION TYPE	
Transmission Type	**Description**
1 to 240	Synchronise The Receive PDO is synchronous. The data in the PDO is processed on reception of the next SYNC object. The actual value of the transmission type is not relevant.
255	Asynchronous As soon as the PDO arrives the data is processed by the node.

14.5   Input Channels Value And All Channels Status Mapping

If each channel uses sixteen bits (analogue is selected for channel data type), then one analogue module requires two TPDOs or RPDOs. Therefore the maximum of thirty two TPDOs or thirty two RPDOs are required for sixteen signal conditioning modules.

If each channel uses only one bit, then the data of eight digital modules will be packed into one TPDO or one RPDO. In this situation, a maximum of two TPDOs / two RPDOs are required for sixteen digital modules. This is only possible when all channels in an Iceni node are digital for either input or output.

The channels can be configured through the User Interface. If 'analogue' is selected, then data for all digital channels will be coded using sixteen bits as 0x0001 or 0x0000.

For each channel 4 bits are needed to hold status info. Node status uses 8 byte. So max 9 status TPDOs are needed for a node (see section 14.5.2 for more detail).

14.5.1 Input Channel Value Mapping

Analogue Data Type

One signal conditioning module uses two TPDO to transmit input channels value.
For each module in a node:

TPDO01:

Byte 0-1:	input channel 1;
byte 2-3:	input channel 2;
byte 4-5:	input channel 3;
byte 6-7:	input channel 4.

TPDO02:

Byte 0-1:	input channel 5;
byte 2-3:	input channel 6;
byte 4-5:	input channel 7;
byte 6-7:	input channel 8.

Digital Data Type

Only two TPDOs are used to transmit all input channels value of 16 signal conditioning modules.
For each node:

TPDO01:

Bit 0 of byte 0:	input channel 1 of module 1;
Bit 1 of byte 0:	input channel 2 of module 1;
Bit 2 of byte 0:	input channel 3 of module 1;
Bit 3 of byte 0:	input channel 4 of module 1;
Bit 4 of byte 0:	input channel 5 of module 1;
Bit 5 of byte 0:	input channel 6 of module 1;
Bit 6 of byte 0:	input channel 7 of module 1;
Bit 7 of byte 0:	input channel 8 of module 1;
Bit 0 of byte 1:	input channel 1 of module 2;
Bit 1 of byte 1:	input channel 2 of module 2;
Bit 2 of byte 1:	input channel 3 of module 2;
Bit 3 of byte 1:	input channel 4 of module 2;
Bit 4 of byte 1:	input channel 5 of module 2;
Bit 5 of byte 1:	input channel 6 of module 2;
Bit 6 of byte 1:	input channel 7 of module 2;
Bit 7 of byte 1:	input channel 8 of module 2;
.	
.	
.	
Bit 0 of byte 7:	input channel 1 of module 8;
Bit 1 of byte 7:	input channel 2 of module 8;
Bit 2 of byte 7:	input channel 3 of module 8;
Bit 3 of byte 7:	input channel 4 of module 8;
Bit 4 of byte 7:	input channel 5 of module 8;
Bit 5 of byte 7:	input channel 6 of module 8;
Bit 6 of byte 7:	input channel 7 of module 8;
Bit 7 of byte 7:	input channel 8 of module 8;

TPDO02:

Bit 0 of byte 0:   input channel 1 of module 9;
Bit 1 of byte 0:   input channel 2 of module 9;
Bit 2 of byte 0:   input channel 3 of module 9;
Bit 3 of byte 0:   input channel 4 of module 9;
Bit 4 of byte 0:   input channel 5 of module 9;
Bit 5 of byte 0:   input channel 6 of module 9;
Bit 6 of byte 0:   input channel 7 of module 9;
Bit 7 of byte 0:   input channel 8 of module 9;

Bit 0 of byte 1:   input channel 1 of module 10;
Bit 1 of byte 1:   input channel 2 of module 10;
Bit 2 of byte 1:   input channel 3 of module 10;
Bit 3 of byte 1:   input channel 4 of module 10;
Bit 4 of byte 1:   input channel 5 of module 10;
Bit 5 of byte 1:   input channel 6 of module 10;
Bit 6 of byte 1:   input channel 7 of module 10;
Bit 7 of byte 1:   input channel 8 of module 10;
.
.
.
Bit 0 of byte 7:   input channel 1 of module 16;
Bit 1 of byte 7:   input channel 2 of module 16;
Bit 2 of byte 7:   input channel 3 of module 16;
Bit 3 of byte 7:   input channel 4 of module 16;
Bit 4 of byte 7:   input channel 5 of module 16;
Bit 5 of byte 7:   input channel 6 of module 16;
Bit 6 of byte 7:   input channel 7 of module 16;
Bit 7 of byte 7:   input channel 8 of module 16;

14.5.2 <u>All Channel Status Mapping</u>

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.

Four bits hold the status for each channel. One TPDO will hold channel status info for two modules.

Channel status TPDO1

0-3 bits of byte 0:	channel 1 of module 1
4-7 bits of byte 0:	channel 2 of module 1
0-3 bits of byte 1:	channel 3 of module 1
4-7 bits of byte 1:	channel 4 of module 1
0-3 bits of byte 2:	channel 5 of module 1
4-7 bits of byte 2:	channel 6 of module 1
0-3 bits of byte 3:	channel 7 of module 1
4-7 bits of byte 3:	channel 8 of module 1
0-3 bits of byte 4:	channel 1 of module 2
4-7 bits of byte 4:	channel 2 of module 2
0-3 bits of byte 5:	channel 3 of module 2
4-7 bits of byte 5:	channel 4 of module 2
0-3 bits of byte 6:	channel 5 of module 2
4-7 bits of byte 6:	channel 6 of module 2
0-3 bits of byte 7:	channel 7 of module 2
4-7 bits of byte 7:	channel 8 of module 2

Channel status TPDO2

0-3 bits of byte 0:	channel 1 of module 3
4-7 bits of byte 0:	channel 2 of module 3
0-3 bits of byte 1:	channel 3 of module 3
4-7 bits of byte 1:	channel 4 of module 3
0-3 bits of byte 2:	channel 5 of module 3
4-7 bits of byte 2:	channel 6 of module 3
0-3 bits of byte 3:	channel 7 of module 3
4-7 bits of byte 3:	channel 8 of module 3
0-3 bits of byte 4:	channel 1 of module 4
4-7 bits of byte 4:	channel 2 of module 4
0-3 bits of byte 5:	channel 3 of module 4
4-7 bits of byte 5:	channel 4 of module 4
0-3 bits of byte 6:	channel 5 of module 4
4-7 bits of byte 6:	channel 6 of module 4
0-3 bits of byte 7:	channel 7 of module 4
4-7 bits of byte 7:	channel 8 of module 4

Channel status TPDO3

0-3 bits of byte 0:	channel 1 of module 5
4-7 bits of byte 0:	channel 2 of module 5
0-3 bits of byte 1:	channel 3 of module 5
4-7 bits of byte 1:	channel 4 of module 5
0-3 bits of byte 2:	channel 5 of module 5
4-7 bits of byte 2:	channel 6 of module 5
0-3 bits of byte 3:	channel 7 of module 5
4-7 bits of byte 3:	channel 8 of module 5
0-3 bits of byte 4:	channel 1 of module 6
4-7 bits of byte 4:	channel 2 of module 6
0-3 bits of byte 5:	channel 3 of module 6
4-7 bits of byte 5:	channel 4 of module 6
0-3 bits of byte 6:	channel 5 of module 6
4-7 bits of byte 6:	channel 6 of module 6
0-3 bits of byte 7:	channel 7 of module 6
4-7 bits of byte 7:	channel 8 of module 6

Channel status TPDO4

0-3 bits of byte 0:	channel 1 of module 7
4-7 bits of byte 0:	channel 2 of module 7
0-3 bits of byte 1:	channel 3 of module 7
4-7 bits of byte 1:	channel 4 of module 7
0-3 bits of byte 2:	channel 5 of module 7
4-7 bits of byte 2:	channel 6 of module 7
0-3 bits of byte 3:	channel 7 of module 7
4-7 bits of byte 3:	channel 8 of module 7
0-3 bits of byte 4:	channel 1 of module 8
4-7 bits of byte 4:	channel 2 of module 8
0-3 bits of byte 5:	channel 3 of module 8
4-7 bits of byte 5:	channel 4 of module 8
0-3 bits of byte 6:	channel 5 of module 8
4-7 bits of byte 6:	channel 6 of module 8
0-3 bits of byte 7:	channel 7 of module 8
4-7 bits of byte 7:	channel 8 of module 8

Channel status TPDO5

0-3 bits of byte 0:	channel 1 of module 9
4-7 bits of byte 0:	channel 2 of module 9
0-3 bits of byte 1:	channel 3 of module 9
4-7 bits of byte 1:	channel 4 of module 9
0-3 bits of byte 2:	channel 5 of module 9
4-7 bits of byte 2:	channel 6 of module 9
0-3 bits of byte 3:	channel 7 of module 9
4-7 bits of byte 3:	channel 8 of module 9
0-3 bits of byte 4:	channel 1 of module 10
4-7 bits of byte 4:	channel 2 of module 10
0-3 bits of byte 5:	channel 3 of module 10
4-7 bits of byte 5:	channel 4 of module 10
0-3 bits of byte 6:	channel 5 of module 10
4-7 bits of byte 6:	channel 6 of module 10
0-3 bits of byte 7:	channel 7 of module 10
4-7 bits of byte 7:	channel 8 of module 10

Channel status TPDO6
0-3 bits of byte 0:	channel 1 of module 11
4-7 bits of byte 0:	channel 2 of module 11
0-3 bits of byte 1:	channel 3 of module 11
4-7 bits of byte 1:	channel 4 of module 11
0-3 bits of byte 2:	channel 5 of module 11
4-7 bits of byte 2:	channel 6 of module 11
0-3 bits of byte 3:	channel 7 of module 11
4-7 bits of byte 3:	channel 8 of module 11
0-3 bits of byte 4:	channel 1 of module 12
4-7 bits of byte 4:	channel 2 of module 12
0-3 bits of byte 5:	channel 3 of module 12
4-7 bits of byte 5:	channel 4 of module 12
0-3 bits of byte 6:	channel 5 of module 12
4-7 bits of byte 6:	channel 6 of module 12
0-3 bits of byte 7:	channel 7 of module 12
4-7 bits of byte 7:	channel 8 of module 12

Channel status TPDO7
0-3 bits of byte 0:	channel 1 of module 13
4-7 bits of byte 0:	channel 2 of module 13
0-3 bits of byte 1:	channel 3 of module 13
4-7 bits of byte 1:	channel 4 of module 13
0-3 bits of byte 2:	channel 5 of module 13
4-7 bits of byte 2:	channel 6 of module 13
0-3 bits of byte 3:	channel 7 of module 13
4-7 bits of byte 3:	channel 8 of module 13
0-3 bits of byte 4:	channel 1 of module 14
4-7 bits of byte 4:	channel 2 of module 14
0-3 bits of byte 5:	channel 3 of module 14
4-7 bits of byte 5:	channel 4 of module 14
0-3 bits of byte 6:	channel 5 of module 14
4-7 bits of byte 6:	channel 6 of module 14
0-3 bits of byte 7:	channel 7 of module 14
4-7 bits of byte 7:	channel 8 of module 14

Channel status TPDO8
0-3 bits of byte 0:	channel 1 of module 15
4-7 bits of byte 0:	channel 2 of module 15
0-3 bits of byte 1:	channel 3 of module 15
4-7 bits of byte 1:	channel 4 of module 15
0-3 bits of byte 2:	channel 5 of module 15
4-7 bits of byte 2:	channel 6 of module 15
0-3 bits of byte 3:	channel 7 of module 15
4-7 bits of byte 3:	channel 8 of module 15
0-3 bits of byte 4:	channel 1 of module 16
4-7 bits of byte 4:	channel 2 of module 16
0-3 bits of byte 5:	channel 3 of module 16
4-7 bits of byte 5:	channel 4 of module 16
0-3 bits of byte 6:	channel 5 of module 16
4-7 bits of byte 6:	channel 6 of module 16
0-3 bits of byte 7:	channel 7 of module 16
4-7 bits of byte 7:	channel 8 of module 16

Node status TPDO9

Byte 0:	Toggled between 0 and 1 every second if heartbeat is disabled from menu or as heartbeat if heartbeat is enabled from menu.
Byte 1:	Total number of signal conditioning modules in the node
Byte 2:	Bit mapped status for module 1 to 8 0 for unhealthy or not fitted 1 for healthy

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit	Bit 0
Module 8	Module 7	Module 6	Module 5	Module 4	Module 3	Module 2	Module 1

Byte 3:	Bit mapped status for module 9 to 16 0 for unhealthy or not fitted 1 for healthy

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit	Bit 0
Module 16	Module 15	Module 14	Module 13	Module 12	Module 11	Module 10	Module 9

Byte 4:	Unused
Byte 5:	Unused
Byte 6:	Unused
Byte 7:	Unused

14.6   Output Channel Data Mapping

14.6.1 <u>Analogue Data Type</u>

One signal conditioning module uses two RPDO to receive data for output channels value.
For each module in a node

<u>*RPDO01:*</u>
          Byte 0-1:   output channel 1;
          Byte 2-3:   output channel 2;
          Byte 4-5:   output channel 3;
          Byte 6-7:   output channel 4.

<u>*RPDO02:*</u>
          Byte 0-1:   output channel 5;
          Byte 2-3:   output channel 6;
          Byte 4-5:   output channel 7;
          Byte 6-7:   output channel 8.

14.6.2 <u>Digital Data Type</u>

Only two RPDOs are used to receive data for all output channels for sixteen signal
conditioning modules.
For each node

<u>*RPDO01:*</u>
          Bit 0 of byte 0: output channel 1 of module 1;
          Bit 1 of byte 0: output channel 2 of module 1;
          Bit 2 of byte 0: output channel 3 of module 1;
          Bit 3 of byte 0: output channel 4 of module 1;
          Bit 4 of byte 0: output channel 5 of module 1;
          Bit 5 of byte 0: output channel 6 of module 1;
          Bit 6 of byte 0: output channel 7 of module 1;
          Bit 7 of byte 0: output channel 8 of module 1;

          Bit 0 of byte 1: output channel 1 of module 2;
          Bit 1 of byte 1: output channel 2 of module 2;
          Bit 2 of byte 1: output channel 3 of module 2;
          Bit 3 of byte 1: output channel 4 of module 2;
          Bit 4 of byte 1: output channel 5 of module 2;
          Bit 5 of byte 1: output channel 6 of module 2;
          Bit 6 of byte 1: output channel 7 of module 2;
          Bit 7 of byte 1: output channel 8 of module 2;
          .
          .
          .
          Bit 0 of byte 7: output channel 1 of module 8;
          Bit 1 of byte 7: output channel 2 of module 8;
          Bit 2 of byte 7: output channel 3 of module 8;
          Bit 3 of byte 7: output channel 4 of module 8;
          Bit 4 of byte 7: output channel 5 of module 8;
          Bit 5 of byte 7: output channel 6 of module 8;
          Bit 6 of byte 7: output channel 7 of module 8;
          Bit 7 of byte 7: output channel 8 of module 8;

RPDO02:

      Bit 0 of byte 0: output channel 1 of module 9;
      Bit 1 of byte 0: output channel 2 of module 9;
      Bit 2 of byte 0: output channel 3 of module 9;
      Bit 3 of byte 0: output channel 4 of module 9;
      Bit 4 of byte 0: output channel 5 of module 9;
      Bit 5 of byte 0: output channel 6 of module 9;
      Bit 6 of byte 0: output channel 7 of module 9;
      Bit 7 of byte 0: output channel 8 of module 9;

      Bit 0 of byte 1: output channel 1 of module 10;
      Bit 1 of byte 1: output channel 2 of module 10;
      Bit 2 of byte 1: output channel 3 of module 10;
      Bit 3 of byte 1: output channel 4 of module 10;
      Bit 4 of byte 1: output channel 5 of module 10;
      Bit 5 of byte 1: output channel 6 of module 10;
      Bit 6 of byte 1: output channel 7 of module 10;
      Bit 7 of byte 1: output channel 8 of module 10;
      .
      .
      .
      Bit 0 of byte 7: output channel 1 of module 16;
      Bit 1 of byte 7: output channel 2 of module 16;
      Bit 2 of byte 7: output channel 3 of module 16;
      Bit 3 of byte 7: output channel 4 of module 16;
      Bit 4 of byte 7: output channel 5 of module 16;
      Bit 5 of byte 7: output channel 6 of module 16;
      Bit 6 of byte 7: output channel 7 of module 16;
      Bit 7 of byte 7: output channel 8 of module 16;

14.7 Error Handling

14.7.1 Emergency Message

Report Error

The ICENI/MA-02 can send an emergency message (COB ID = 0x80 + node ID) to notify any node faults. There are three types of fault, namely Module / Channel error, CAN communication error and PDO error.

The following tables show a description of the emergency message used to report errors:

HEALTHY CHANNEL							
Description	**Emergency Error Code**		**Error Register**	**Manufacturer Specific Error Code**			
				Error Code	**Channel / Module / Node Number**			
	Byte0	**Byte1**	**Byte2**	**Byte3**	**Byte4**	**Byte5**	**Byte6**	**Byte7**
Healthy	0x00	0x00	0x00	0x00				

MODULE / CHANNEL ERRORS							
Description	**Emergency Error Code**		**Error Register**	**Manufacturer Specific Error Code**			
				Error Code	**Channel / Module / Node Number**			
	Byte0	**Byte1**	**Byte2**	**Byte3**	**Byte4**	**Byte5**	**Byte6**	**Byte7**
Channel Status	0x00	0xFF	0x81	channel status (see specific Iceni signal conditioning module user guide for operating status values)	0x1–0x80 (channel)			
Channel Invalid	0x00	0xFF	0x81	0x07 (if channel is not available)	0x1–0x80 (channel)			
Module Lost	0x00	0xFF	0x81	0x08 (if Iceni signal conditioning module fails)	0x1–0x10 (module)			

COMMUNICATION ERRORS							
Description	**Emergency Error Code**		**Error Register**	**Manufacturer Specific Error Code**			
				Error Code	**Channel / Module / Node Number**		
	Byte0	**Byte1**	**Byte2**	**Byte3**	**Byte4**	**Byte5**	**Byte6**	**Byte7**
TX bus off	0x00	0x81	0x11	0x11	0x1–0xF (node)			
TX bus Passive	0x20	0x81	0x11	0x12	0x1–0xF (node)			
RX bus Passive	0x20	0x81	0x11	0x13	0x1–0xF (node)			
TX Warning	0x00	0x81	0x11	0x14	0x1–0xF (node)			
RX Warning	0x00	0x81	0x11	0x15	0x1–0xF (node)			
Can warning	0x00	0x81	0x11	0x16	0x1–0xF (node)			
Invalid MSG	0x00	0x81	0x11	0x17	0x1–0xF (node)			
RX Overflow	0x10	0x81	0x11	0x18	0x1–0xF (node)			
Error Interrupt	0x00	0x81	0x11	0x19	0x1–0xF (node)			
Heartbeat Message Not Received	0x30	0x81	0x11	0x1F	0x1–0xF (node)			
CAN-ID collision	0x50	0x81	0x11	0x1E	0x1–0xF (node)			

PDO ERRORS							
Description	**Emergency Error Code**		**Error Register**	**Manufacturer Specific Error Code**			
				Error Code	**Channel / Module / Node Number**		
	Byte0	**Byte1**	**Byte2**	**Byte3**	**Byte4**	**Byte5**	**Byte6**	**Byte7**
RPDO Data Length Error	0x10	0x82	0x01	0x21	0x1 – 0xF (node)			

For example: ID (in Hex)   Message (in Hex)
(for node 2)

82   00 FF 81 01 19 00 00 00

Means that channel 1 of Iceni signal conditioning module 4 has a fault (modules 1 to three have eight channels each so this is channel 25)

The fault code for the channel is 1.

Report Error Being Reset

The error reset emergency message will be sent if the error has been cleared.

The following tables show a description of the error reset emergency message:

Description	Emergency Error Code		Error Register	Manufacturer Specific Error Code				
				Error Code	Channel / Module / Node Number			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Error Reset	0x00	0x00	0x00 (healthy) 0x81 (with Module / Channel Errors) 0x11 (with Communication Errors)	0x00	0x00 or 0x1–0xF (node number) for heartbeat only			

For example: ID (in Hex)   Message (in Hex)
                 82   00 00 00 00 00 00 00 00

Means that there is no error in the node.

14.7.2 Abort SDO Transfer

All Object Dictionary reads or writes are performed using SDOs. At any time the ICENI/MA-02 may abort an SDO transmission. The following error codes give an indication as to why the transfer was aborted.

Abort Code (in hex)	Description
0x05030000	Toggle Bit not alternated
0x05050000	SDO Protocol timed out
0x05040001	Client / Server command specified not valid or unknown
0x05040002	Invalid block size (block mode)
0x05040003	Invalid sequence number (block mode)
0x05040004	CRC error (block mode)
0x05040005	out of memory
0x06010000	Unsupported access to an object
0x06010001	Attempt to read a write only object
0x06010002	Attempt to write a read only object
0x06020000	Object does not exist in the Object Dictionary
0x06040041	Object cannot be mapped to the PDO
0x06040042	The number and length of the Object to be mapped would exceed the PDO length
0x06040043	General parameter incompatibility
0x06040047	General internal incompatibility in the device
0x06060000	Access failed due to a hardware error
0x06070010	Data type does not match. Length of service parameter does not match
0x06070012	Data type does not match. Length of service parameter is too high
0x06070013	Data type does not match. Length of service parameter is too low
0x06090011	Sub-index does not exist
0x06090030	Value range of parameter exceeded (write access only)
0x06090031	Value of parameter written is too high
0x06090032	Value of parameter written is too low
0x06090036	Maximum value is less than the minimum value
0x08000000	General error
0x08000020	Data cannot be transferred or stored to application
0x08000021	Data cannot be transferred or stored to application because of local control
0x08000022	Data cannot be transferred or stored to application because of the present device state
0x08000023	Object Dictionary dynamic generation fails or no Object Dictionary is present (e.g. Object Dictionary is generated from file and generation fails because of a file error)

For example: ID (in Hex)   Message (in Hex)
(for node 3)   583   80 00 22 00 00 00 02 06

Means that the abort message is from node 3 and that the object (index 0x2200, sub-index 0x00) does not exist in the Object Dictionary.

14.8 Object Dictionary

Explanation of abbreviations:

0x...	=	hexadecimal numerical value
rw	=	read-write
ro	=	read only
wo	=	write only
UNS8	=	unsigned 8 bit
UNS16	=	unsigned 16 bit
UNS32	=	unsigned 32 bit
Int16	=	signed 16 bit

14.8.1 Communication Entries

Index	Sub-Index	Name	Type	Default	Description
0x1000	0x00	Device type	UNS32, ro	0x008F0191	
0x1001	0x00	Error Register	UNS8, ro	0x00	Error Register : content is 'Object Entry 0x1001 (Error Register)'
0x1003		Pre-Defined Error Field			
	0x00	Number of error	UNS8, rw	0x00	=00h the Number of error
	0x01	Standard Error Field	UNS32, ro	0x00000000	Standard Error Field : content is 'Object entry 0x1003 (Pre-defined Error)'
	.				
	.				
	.				
	0x0F	Standard Error Field	UNS32, ro	0x00000000	Standard Error Field : content is 'Object entry 0x1003 (Pre-defined Error)'
0x1005	0x00	COB-ID SYNC	UNS32, rw	0x00000080	
0x1006	0x00	Communication Cycle Period	UNS32, rw	0x00000000	
0x1014	0x00	Emergency COB ID	UNS32, ro	0x00000080 + Node ID	
0x1016		Consumer Heartbeat time			Consumer Heartbeat
	0x00	Number of entries	UNS8, ro		= 15 Number of entries
	0x01	Consumer Heartbeat time	UNS32, rw	0x00000000	
	.				
	.				
	.				
	0x0F	Consumer Heartbeat time	UNS32, rw	0x00000000	
0x1017	0x00	Producer heartbeat time	UNS16, rw	0x0000	Heartbeat Time (in ms)

Index	Sub-Index	Name	Type	Default	Description
0x1018			ro		Identity Object
0x1027		Module List			Module List
	0x00	Number of entries	UNS8, ro		=0 Number of connected modules
	0x01	Module 1	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x02	Module 2	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x03	Module 3	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x04	Module 4	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x05	Module 5	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x06	Module 6	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x07	Module 7	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x08	Module 8	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x09	Module 9	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0A	Module 10	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0B	Module 11	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0C	Module 12	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0D	Module 13	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0E	Module 14	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x0F	Module 15	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
	0x10	Module 16	UNS16, ro		Unique module number - content is 'Object entry 0x1027 (Module List)'
0x1029					Error behaviour
	0x00		UNS8, ro		=2d (Number of sub-index entries)
	0x01		UNS8, rw	0x01 (remain in current NMT state)	Communication error • 00h = transit to NMT pre-operational (only if the current NMT state is operational) state • 01h = remain in current NMT state • 02h = transit to NMT stopped state
	0x02		UNS8, rw	0x01 (remain in current NMT state)	Node ID collision Error • 00h = transit to NMT pre-operational (only if the current NMT state is operational) state • 01h = remain in current NMT state • 02h = transit to NMT stopped state

Object Entry 0x1001 (Error Register)

Description	Error Register (UNS8)
Healthy	0x00
Channel Error 1	0x81
Channel Invalid	0x81
Module Lost	0x81
TX bus Off	0x11
TX Bus Passive	0x11
RX Bus Passive	0x11
TX Warning	0x11
RX Warning	0x11
Can Warning	0x11
Invalid MSG	0x11
RX Overflow	0x11
Error Interrupt	0x11
CAN-ID collision	0x11
Heartbeat Error	0x11
RPDO data Length Error	0x01

Object entry 0x1003 (Pre-defined Error)

HEALTHY CHANNEL				
	Emergency Error Code		Manufacturer Specific Additional Information	
			Error Code	Channel / Module / Node Number
	Byte0	Byte1	Byte2	Byte3
Healthy	0x00	0x00	0x00	

MODULE ERRORS				
	Emergency Error Code		Manufacturer Specific Additional Information	
			Error Code	Channel / Module / Node Number
	Byte0	Byte1	Byte2	Byte3
Channel Error	0x00	0xFF	channel status (see specific Iceni signal conditioning module user guide for operating status values)	0x1 – 0x80 (channel)
Channel Invalid	0x00	0xFF	0x07	0x1 – 0x80 (channel)
Module Lost	0x00	0xFF	0x08	0x1 – 0x10 (module)

COMMUNICATIONS ERRORS				
	Emergency Error Code		Manufacturer Specific Additional Information	
			Error Code	Channel / Module / Node Number
	Byte0	Byte1	Byte2	Byte3
TX Bus Off	0x00	0x81	0x11	0x1 – 0xF (node)
TX Bus Passive	0x20	0x81	0x12	0x1 – 0xF (node)
RX Bus Passive	0x20	0x81	0x13	0x1 – 0xF (node)
TX Warning	0x00	0x81	0x14	0x1 – 0xF (node)
RX Warning	0x00	0x81	0x15	0x1 – 0xF (node)
Can warning	0x00	0x81	0x16	0x1 – 0xF (node)
Invalid MSG	0x00	0x81	0x17	0x1 – 0xF (node)
RX Overflow	0x10	0x81	0x18	0x1 – 0xF (node)
Error Interrupt	0x00	0x81	0x19	0x1 – 0xF node)
Heartbeat Message Not Received	0x30	0x81	0x1F	0x1 – 0xF (node)
CAN-ID collision	0x50	0x81	0x1E	0x1 – 0xF (node)

PDO ERRORS				
	Emergency Error Code		Manufacturer Specific Additional Information	
			Error Code	Channel / Module / Node Number
	Byte0	Byte1	Byte2	Byte3
RPDO data Length Error	0x10	0x82	0x21	0x1 – 0xF (node)

Object entry 0x1027 (Module List)

Description	Bits															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Module Part Number	1st Letter					2nd Letter					Numeric Number					
Content of 0x1027	Numerical number 1 – 26 present letters A(a) to Z(z) (not case sensitive)					Numerical number 1 – 26 present lesters A(a) to Z(z) (not case sensitive)					1 - 64					

For example:

For digital input signal conditioning module ICENI/DI-01, data will be 0x2241

The data is decoded as follows:

Description	Bits															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Module Part Number	1st Letter D					2nd Letter I					Numeric Number 01					
Digital Module ICENI/DI-01	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1
	4					9					1					

14.8.2 Manufacturer Specific Entries

Channel status

Index	Sub-Index	Name	Type	Default	Description
0x2000	0x00	Module 01 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status[10] bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2001	0x00	Module 02 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2002	0x00	Module 03 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2003	0x00	Module 04 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2004	0x00	Module 05 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2005	0x00	Module 06 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status

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[10] See section 14.5.2 for channel status info define

Index	Sub-Index	Name	Type	Default	Description
0x2006	0x00	Module 07 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status[11] bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2007	0x00	Module 08 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2008	0x00	Module 09 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x2009	0x00	Module 10 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x200A	0x00	Module 11 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x200B	0x00	Module 12 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status

[11] See section 14.5.2 for channel status info define

Index	Sub-Index	Name	Type	Default	Description
0x200C	0x00	Module 13 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status[12] bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x200D	0x00	Module 14 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x200E	0x00	Module 15 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status
0x200F	0x00	Module 16 channel status	UNS8, ro	0x04	04h= Highest sub-index supported
	0x01		UNS8, ro		bit0-3: channel 01 status bit4-7: channel 02 status
	0x02		UNS8, ro		bit0-3: channel 03 status bit4-7: channel 04 status
	0x03		UNS8, ro		bit0-3: channel 05 status bit4-7: channel 06 status
	0x04		UNS8, ro		bit0-3: channel 07 status bit4-7: channel 08 status

Node / Module Status

Index	Sub-Index	Name	Type	Default	Description
2100	0x00	Node/module status	UNS8, ro	0x08	08h= Highest sub-index supported
	0x01		UNS8, ro		Toggled between 0 and 1 every one second if heartbeat is disabled from menu or as heartbeat if heartbeat is enabled from menu.
	0x02		UNS8, ro		Total number of modules in the node
	0x03		UNS8, ro		Bit mapped[13] status for module 1 to 8 0 for unhealthy or not fitted 1 for healthy
	0x04		UNS8, ro		Bit mapped[14] status for module 9 to 16 0 for unhealthy or not fitted 1 for healthy
	0x05		UNS8, ro	00h	Unused
	0x06		UNS8, ro	00h	Unused
	0x07		UNS8, ro	00h	Unused
	0x08		UNS8, ro	00h	Unused

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[12] See section 14.5.2 for channel status info define
[13] See section 14.5.2 - Node status TPDO9
[14] See section 14.5.2 - Node status TPDO9

15 EXTERNALLY SAVED PARAMETERS LIST

Flowing the procedure in section '13.2 Storage of Externally configured Parameters', parameters listed in the tables below will be saved into EEPROM memory.

CANopen Object		Description	
Index	Sub-index		
0x1400		RPDO01 COB ID	for module 1
0x1401		RPDO02 COB ID	
0x1402		RPDO01 COB ID	for module 2
0x1403		RPDO02 COB ID	
0x1404		RPDO01 COB ID	for module 3
0x1405		RPDO02 COB ID	
0x1406		RPDO01 COB ID	for module 4
0x1407		RPDO02 COB ID	
0x1408		RPDO01 COB ID	for module 5
0x1409		RPDO02 COB ID	
0x140A		RPDO01 COB ID	for module 6
0x140B		RPDO02 COB ID	
0x140C		RPDO01 COB ID	for module 7
0x140D		RPDO02 COB ID	
0x140E		RPDO01 COB ID	for module 8
0x140F	0x01	RPDO02 COB ID	
0x1410		RPDO01 COB ID	for module 9
0x1411		RPDO02 COB ID	
0x1412		RPDO01 COB ID	for module 10
0x1413		RPDO02 COB ID	
0x1414		RPDO01 COB ID	for module 11
0x1415		RPDO02 COB ID	
0x1416		RPDO01 COB ID	for module 12
0x1417		RPDO02 COB ID	
0x1418		RPDO01 COB ID	for module 13
0x1419		RPDO02 COB ID	
0x141A		RPDO01 COB ID	for module 14
0x141B		RPDO02 COB ID	
0x141C		RPDO01 COB ID	for module 15
0x141D		RPDO02 COB ID	
0x141E		RPDO01 COB ID	for module 16
0x141F		RPDO02 COB ID	

CANopen Object		Description	
Index	Sub-index		
0x1800		TPDO01 inhibit time	for module 1
0x1801		TPDO02 inhibit time	
0x1802		TPDO01 inhibit time	for module 2
0x1803		TPDO02 inhibit time	
0x1804		TPDO01 inhibit time	for module 3
0x1805		TPDO02 inhibit time	
0x1806		TPDO01 inhibit time	for module 4
0x1807		TPDO02 inhibit time	
0x1808		TPDO01 inhibit time	for module 5
0x1809		TPDO02 inhibit time	
0x180A		TPDO01 inhibit time	for module 6
0x180B		TPDO02 inhibit time	
0x180C		TPDO01 inhibit time	for module 7
0x180D		TPDO02 inhibit time	
0x180E		TPDO01 inhibit time	for module 8
0x180F		TPDO02 inhibit time	
0x1810		TPDO01 inhibit time	for module 9
0x1811		TPDO02 inhibit time	
0x1812		TPDO01 inhibit time	for module 10
0x1813		TPDO02 inhibit time	
0x1814	0x03	TPDO01 inhibit time	for module 11
0x1815		TPDO02 inhibit time	
0x1816		TPDO01 inhibit time	for module 12
0x1817		TPDO02 inhibit time	
0x1818		TPDO01 inhibit time	for module 13
0x1819		TPDO02 inhibit time	
0x181A		TPDO01 inhibit time	for module 14
0x181B		TPDO02 inhibit time	
0x181C		TPDO01 inhibit time	for module 15
0x181D		TPDO02 inhibit time	
0x181E		TPDO01 inhibit time	for module 16
0x181F		TPDO02 inhibit time	
0x1820		Channel status TPDO1 inhibit time	For module 1 & 2
0x1821		Channel status TPDO2 inhibit time	For module 3 & 4
0x1822		Channel status TPDO3 inhibit time	For module 5 & 6
0x1823		Channel status TPDO4 inhibit time	For module 7 & 8
0x1824		Channel status TPDO5 inhibit time	For module 9 & 10
0x1825		Channel status TPDO6 inhibit time	For module 11 & 12
0x1826		Channel status TPDO7 inhibit time	For module 13 & 14
0x1827		Channel status TPDO8 inhibit time	For module 15 & 16
0x1828		Node status TPDO9 inhibit time	For node status

CANopen Object		Description
Index	**Sub-index**	
0x1820	0x05	Channel status TPDO1 event time for module 1 & 2
0x1821		Channel status TPDO2 event time for module 3 & 4
0x1822		Channel status TPDO3 event time for module 5 & 6
0x1823		Channel status TPDO4 event time for module 7 & 8
0x1824		Channel status TPDO5 event time for module 9 & 10
0x1825		Channel status TPDO6 event time for module 11 & 12
0x1826		Channel status TPDO7 event time for module 13 & 14
0x1827		Channel status TPDO8 event time for module 15 & 16
0x1828		Node status TPDO9 event time for node status
0x1820	0x02	Channel status TPDO1 transmission type for module 1 & 2
0x1821		Channel status TPDO2 transmission type for module 3 & 4
0x1822		Channel status TPDO3 transmission type for module 5 & 6
0x1823		Channel status TPDO4 transmission type for module 7 & 8
0x1824		Channel status TPDO5 transmission type for module 9 & 10
0x1825		Channel status TPDO6 transmission type for module 11 & 12
0x1826		Channel status TPDO7 transmission type for module 13 & 14
0x1827		Channel status TPDO8 transmission type for module 15 & 16
0x1828		Node status TPDO9 transmission type for node status
0x1005	0x00	COB-ID SYNC
0x1006	0x00	Communication Cycle Period
0x1016	0x01	Consumer Heartbeat time
	0x02	Consumer Heartbeat time
	0x03	Consumer Heartbeat time
	0x04	Consumer Heartbeat time
	0x05	Consumer Heartbeat time
	0x06	Consumer Heartbeat time
	0x07	Consumer Heartbeat time
	0x08	Consumer Heartbeat time
	0x09	Consumer Heartbeat time
	0x10	Consumer Heartbeat time
	0x11	Consumer Heartbeat time
	0x12	Consumer Heartbeat time
	0x13	Consumer Heartbeat time
	0x14	Consumer Heartbeat time
	0x15	Consumer Heartbeat time
0x1029	0x01	Error behaviour for communication error
	0x02	Error behaviour for device profile or manufacturer specific error

16   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)
20	50	87.5	2500
50	20	87.5	1000
125	8	87.5	500
250	4	87.5	250
500	2	87.5	100
800	1.25	85	50
1000	1	87.5	25

17   SOFTWARE VERSION

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

K0014/001
K0015/001

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	04.04.11	MMB & XZ	Original
2	22.04.14	MMB & XZ	Major update of format and content

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