REMIO

DeviceNet
Communications Interface

for the NON communicating TE series thyristor units

Communications Manual

EUROTHERM AUTOMATION has made every effort to ensure that the specification given in this manual is as accurate and up to the minute as possible. However, in order to maintain our 'leading edge', it may be necessary to make certain changes or omissions to our specification. We cannot be held responsible for any damage to persons or property or for any financial loss or costs arising from this.

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CONTENTS

1. INTRODUCTION

The purpose of this manual is to describe the REMIO DeviceNet interface for the NON communicating TE series thyristor units.

Following documents have been used for the product development:

- Standard ISO/IEC 8802-2: Information processing systems.
  Logical Link Control.

- Standard ISO/IEC 8802-3: Information processing systems.
  Carrier Sense Multiple Access with collision detection (CSMA/CD) access method and physical layer specifications.

- Standard CEI 1131-3: programmable controllers
  programming Languages

- DeviceNet Specifications: Release 2.0 + errata 1 + errata 2

- BOSCH / CAN Specifications: Version 2.0 - Part A

- SJA1000 specifications dated 04 november 1997.

Following documents have been used for the conformance testing:

- DeviceNet Protocol Test Specification version A-13 .

- ODVA Test Procedure for Physical Layer, Indicators and Switches Revision B4.

- DeviceNet Interoperability Test Specification Revision 2.01.

2. GENERAL PRODUCT SPECIFICATIONS

For complete specifications information, please refer to˚:
-User Manual HA175874ENG Iss.2.2 REMIO/TPO or
-User Manual HA175726ENG Iss.2.1 REMIO/Digital (DI/DO).

2.1. REMIO DEVICENET Interface characteristics:

The REMIO Interface is a DeviceNet Slave Module according to the DeviceNet Specifications release 2.0.

This product has been tested by ODVA s authorised Independent Test Lab and found to comply with ODVA Conformance Test Software Version A13, Physical Layer Test Version B4 and Interoperability Test Version C2.

Certification tests carried out at Warwick University Laboratory (U.K.).

Layer 1 and 2 of the OSI model are controlled by a specific component: SJA1000.

Bus connection using shielded twisted pair .

Communication speed: selected by switches
125, 250, 500 kbauds.

Module and network Status indicated by 2 bi-color LEDs. (See chapter 9)

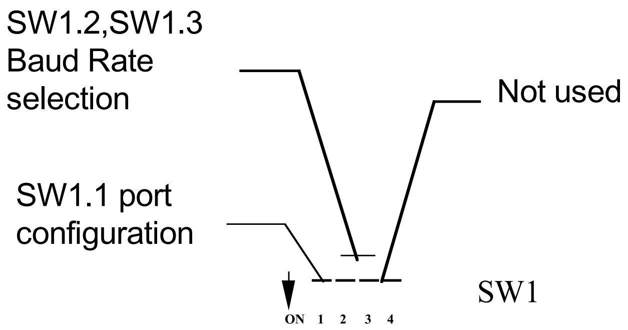
Address set directly through the link from the Master (Unit address can be set or changed from the bus without any switch or jumper).
Exiting the factory, the address of the unit is set to 32 (decimal).

A Watchdog Timer monitors the elapsed time between two messages. In case of error, all the ports are set to logical 0 level in order to avoid malfunction. The watchdog is reset with each error free frame received, on recognition of the Station Number (MACID).
The Time Out can be programmed from an appropriate control software.

No redundancy available.

2.2. . Baud Rate Selection

2 Switches on the top of the main board give the possibility to select the communication speed:



SW1.2	SW1.3	Baud Rate
OFF	OFF	125 kbauds
ON	OFF	250 kbauds
OFF	ON	500 kbauds
ON	ON	Not allowed

3. FUNCTIONALITY

3.1. General concept

The REMIO Interface Module is a DeviceNet Slave Module according to the specification release 2.0 which provides simple connection capability to the bus for thyristors unit of the TE Series.

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4. INSTALLATION:

4.1. Addressing :

Before to start a communicating system, it must be assigned an unmatched address to each station.
For this purpose, the initial address (factory setting) is set to 32 (decimal). This address is stored in the internal non-volatile memory of the unit and must be changed by the user before connecting to the link.

Remember than only 64 addresses (MACID) are available on one DeviceNet Link.

4.2. Connections:

4.2.1. Connections located on the basic module:

4.2.1.1. DeviceNet Connector:

The 5-pins connector on the bottom of the unit is used to connect the bus s shielded twisted pair to the Interface.

5	4	3	2	1
Ø	Ø	Ø	Ø	Ø
V+	CANH	Drain	CANL	V-

The communication electronics is insulated from the control electronics.

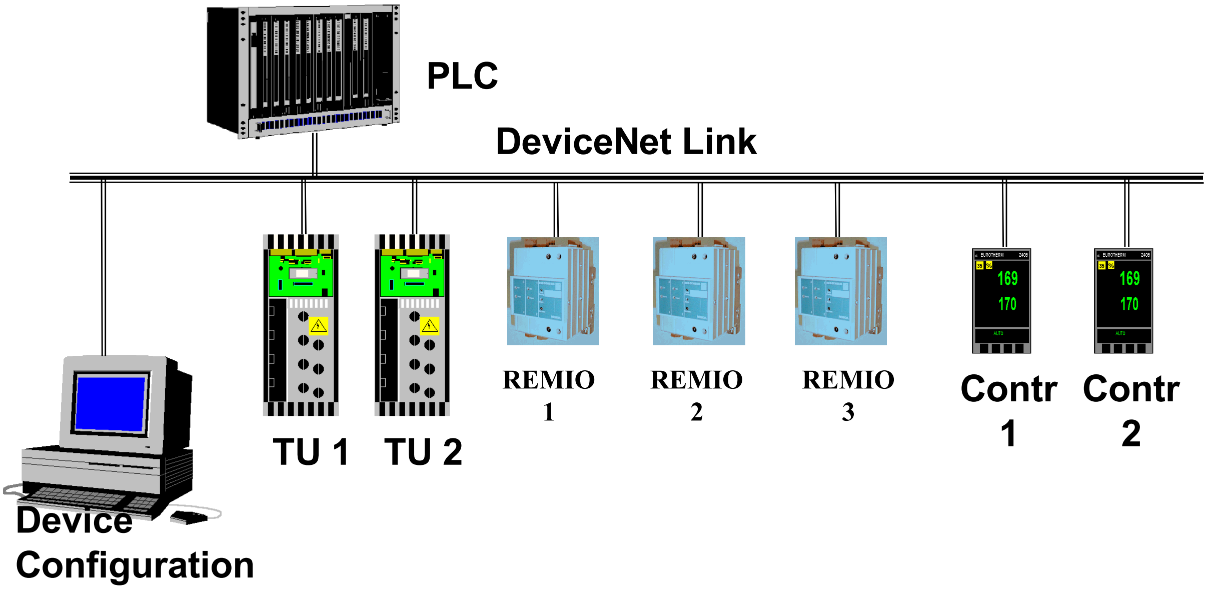
The earth terminal is accessible near the communication connector for shielding purposes.

Wiring and shielding information are described in the REMIO User Manuals (HA175874ENG for REMIO TPO or HA175726ENG for REMIO DI/DO).
It must be particularly paid attention to the line impedance, to the impedance adaptation, maximal length, etc....
Follow carefully the DeviceNet recommendation for terminating the Bus line with an appropriate impedance.

5. SCOPE OF DEVICENET

DeviceNet™ is a low level network that provides connections between simple industrial devices (sensors, actuators) and higher level devices (controllers).

5.1. Example DeviceNet Communication Link



DeviceNet provides:

- A cost effective solution to low level device networking
- Access to intelligence present in low level devices
- Master/Slave and Peer to Peer capabilities

DeviceNet has two primary purposes:

- Transport of control oriented information associated with low level devices
- Transport of other information which is indirectly related to the system being controlled, such as configuration parameters.

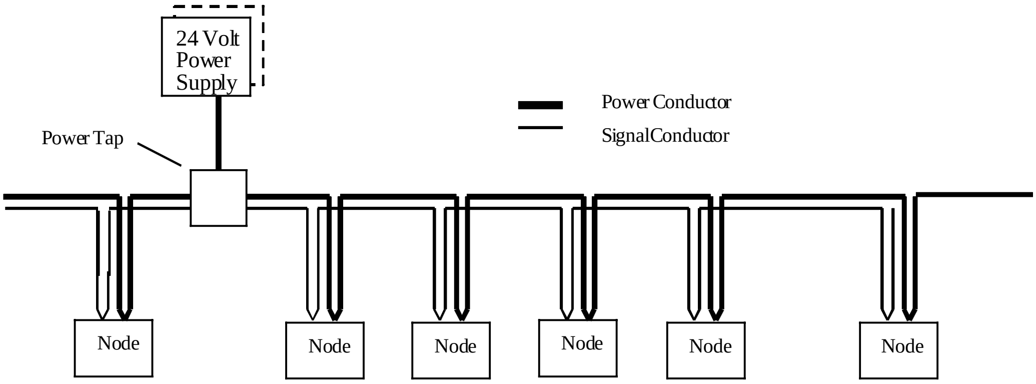
5.2. DeviceNet characteristics

The list below presents a summary of the Physical/Media specific characteristics of DeviceNet:

- Trunk line and/or drop line configuration
- Support for up to 64 nodes
- Node removal without severing the network
- Simultaneous support for both network powered (sensors) and self powered (actuators) devices
- Use of sealed or open style connectors
- Protection from wiring errors
- Selectable data rates of 125 kbaud, 250 kbaud, and 500 kbaud

Data Rate	Trunk Distance	Drop Length	
		Maximum	Cumulative
125 kbaud	500 meters (1640 ft.)	6 meters (20 ft.)	156 meters (512 ft.)
250 kbaud	250 meters (820 ft.)	6 meters (20 ft.)	78 meters (256 ft.)
500 kbaud	100 meters (328 ft.)	6 meters (20 ft.)	39 meters (128 ft.)

- Adjustable power configuration to meet individual application needs
- High current capability (up to 16 amps per supply)
- Operation with off the shelf power supplies
- Power taps that allow the connection of several power supplies from multiple vendor that comply with DeviceNet standards
- Built-in overload protection
- Power available along the bus: both signal and power lines contained in the trunk line



The list below summarises additional communication features provided by DeviceNet:

- Use of Controller Area Network (CAN) technology for Media Access Control and Physical Signalling
- Connection based model to facilitate application to application communications
- Provisions for the typical request/response oriented network communications
- Provisions for the efficient movement of I/O data
- Fragmentation for moving larger bodies of information
- Duplicate MAC ID detection

5.3. DeviceNet and CAN

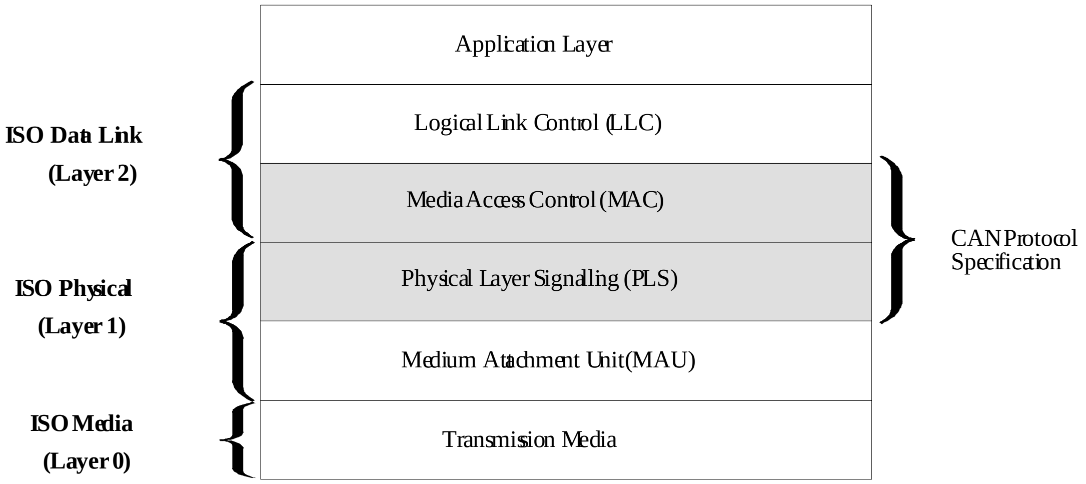
DeviceNet uses the Controller Area Network (CAN) technology. CAN has been accepted for use in automobile applications, and integrated circuits are now available from multiple vendors.
This chapter presents a general overview of CAN.

5.3.1. The scope of CAN

CAN is a communications protocol specification which defines the following:

- A Media Access Control (MAC) methodology
- Physical Signalling

CAN does not specify the entire Physical Layer and/or Medium upon which it resides, or the Application Layer protocol used to move data.



5.3.2. CAN link level addressing

CAN is a broadcast oriented protocol.
The various frames transmitted on the network are assigned an identifier and each station decides, based on this identifier, whether or not it receives the frame.
This identifier is specified in the Identifier Field of a CAN frame.

5.3.3. CAN frame types

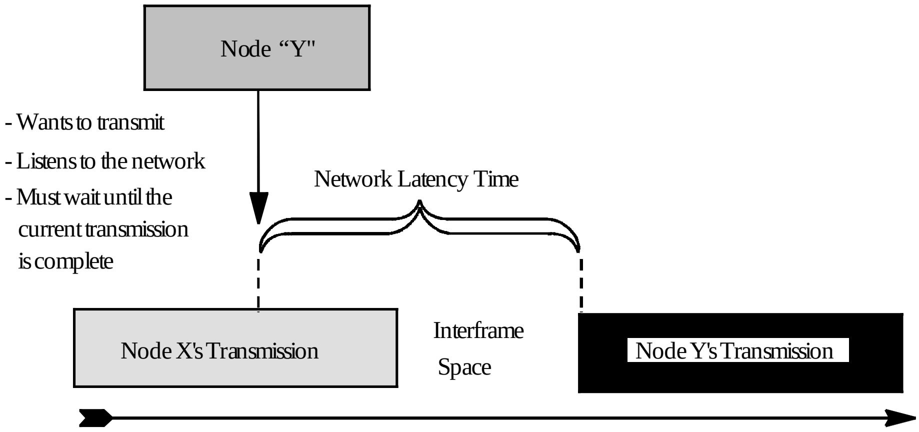
The following frame types are defined by CAN:

- Data Frame: _ Moves data from a transmitter to the receiver(s).
- Remote Frame: _ Requests transmission of the Data Frame associated with the specified identifier (DeviceNet does not make use of the CAN Remote Frame).
- Error Frame: _ Signifies that a node has detected a bus/network error. Two types of the Error Frame exist, based on the state of the node.
- Overload Frame: _ Provides a delay between the transmission of frames to control the flow of data.

5.3.4. CAN Media Access Control

A node s transmission on CAN is heard and acknowledged by ALL other nodes on the network. Whenever the bus is free of transmission, a node can begin to transmit. If a node is transmitting, this transmission must be completed before another node can attempt to transmit.

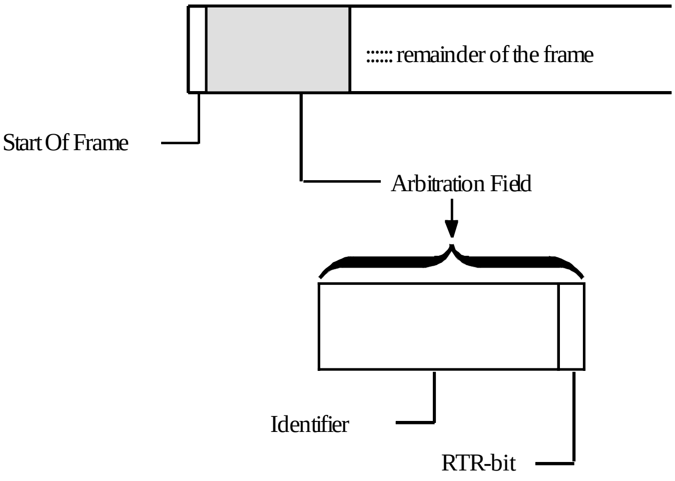
CAN Media Access :



If two or more nodes begin transmitting at the same time, the conflict is resolved by a non destructive bitwise arbitration algorithm using the Arbitration Field.
The Arbitration Field is included in all CAN Data Frames.
The Arbitration Field comprises:

- the 11_bit CAN Identifier Field.
- RTR bit (always set to 0 in the DeviceNet protocol).

Arbitration Field:



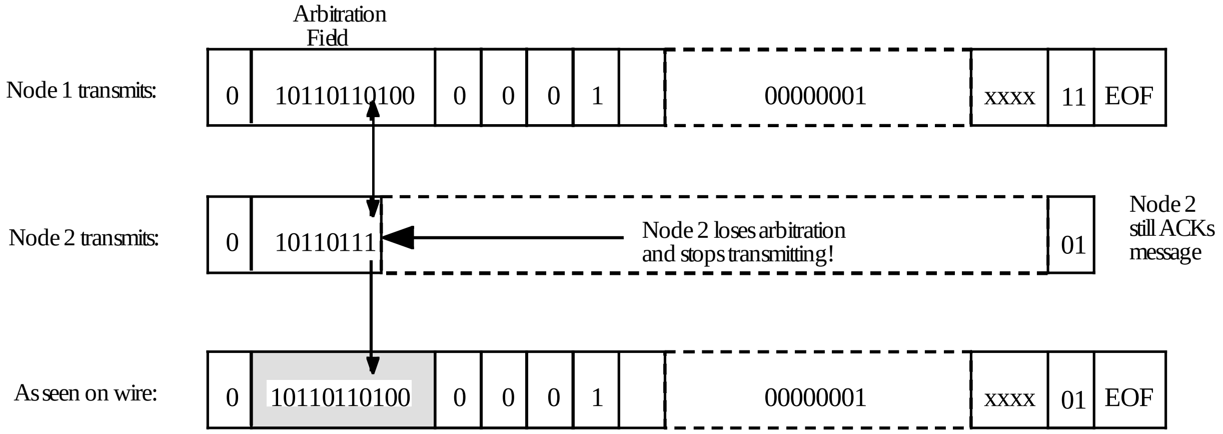
The 11_bit Identifier Field is transmitted from most significant to least significant bit.
A bit on the bus can be either dominant (value 0) or recessive (value 1). Simultaneous transmission of a dominant bit and a recessive bit results in the presence of a dominant bit.
Refer to section 9-1.3 vol. 1 of the DN specifications for information concerning DeviceNet s representation of the dominant and recessive levels.

Important: Since DeviceNet does not make use of the CAN provided Remote Frame, the RTR bit is always dominant.

During transmission of the Arbitration Field, every transmitter monitors the current level on the bus and compares it with the bit it has transmitted. If the values are equal, then the node is able to continue the transmission.
If a recessive bit (value 1) was transmitted and a dominant bit (value 0) is monitored on the bus, then the transmitting node has lost the arbitration sequence and must discontinue the transmission without sending any more data.
The node that lost arbitration can attempt the transmission again when the current transmission is complete.

Important: The identifier with the lowest value wins the arbitration sequence.

Example of Bitwise Arbitration :



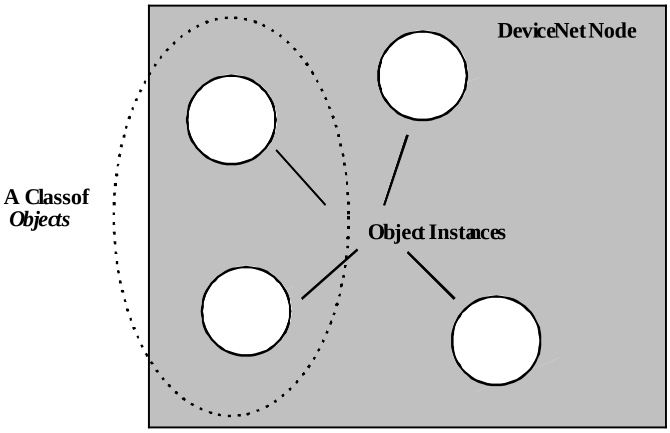
5.4. Object modelling

DeviceNet makes use of abstract object modelling to describe:

- The suite of communication services available
- The externally visible behaviour of a DeviceNet node
- A common means by which information within DeviceNet products is accessed and exchanged

A DeviceNet node is modelled as a collection of Objects.
An Object provides an abstract representation of a particular component within a product.
The realisation of this abstract object model within a product is implementation dependent.
In other words, a product internally maps this object model in a fashion specific to its implementation.
A Class is a set of Objects that all represent the same kind of system component.
An Object Instance is the actual representation of a particular Object within a Class.
Each Instance of a Class has the same set of attributes, but has its own particular set of attribute values.
As illustrated below, multiple Object Instances within a particular Class can reside in a DeviceNet node.

A Class of Objects



An Object Instance and/or an Object Class has Attributes, provides Services, and implements a Behaviour.
Attributes are characteristics of an Object and/or an Object Class.
Typically, Attributes provide status information or govern the operation of an Object.
Services are invoked to trigger the Object/Class to perform a task.
The Behaviour of an Object indicates how it responds to particular events.
For example; a person can be abstractly viewed as an Instance within the Class Human.
Generally speaking, all humans have the same set of attributes: age, sex, etc. Yet, because the values of each attribute vary, each of us looks/behaves in a distinct fashion.

Class	Instances	Attributes	Attribute Values
Human	Mary	Sex	Female
		Age	31
	Jerry	Sex	Male
		Age	50

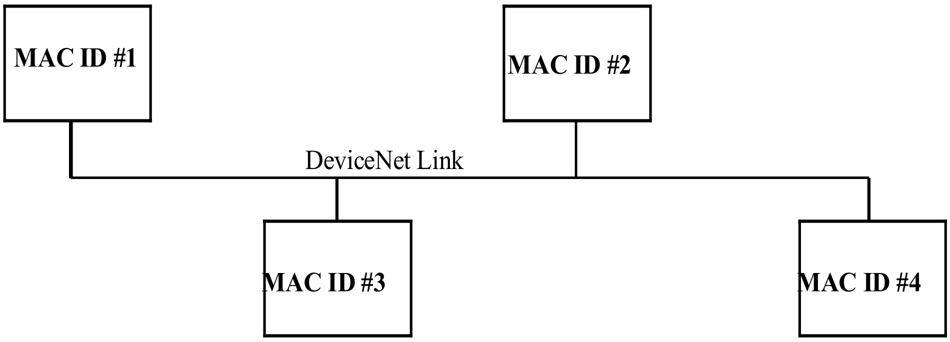
The following Object Modelling related terms are used when describing DeviceNet services and protocol.

- Object — An abstract representation of a particular component within a product.
- Class — A set of objects that all represent the same kind of system component. A class is a generalisation of an object. All objects in a class are identical in form and behaviour, but may contain different attribute values.
- Instance — A specific and real (physical) occurrence of an object. For example: California is an instance of the object class State. The terms Object, Instance, and Object Instance all refer to a specific Instance.
- Attribute — A description of an externally visible characteristic or feature of an object. Typically, attributes provide status information or govern the operation of an Object. For example: the ASCII name of an object; and the repetition rate of a cyclic object.
- Instantiate - To create an instance of an object with all instance attributes initialised to zero unless default values are specified in the object definition.
- Behaviour — A specification of how an object acts. Actions result from different events the object detects, such as receiving service requests, detecting internal faults or elapsing timers.
- Service — A function supported by an object and/or object class. DeviceNet defines a set of common services and provides for the definition of Object Class and/or Vendor Specific services. DeviceNet common services are those whose parameters and required behaviours are defined in Appendix G.
- Communication Objects _ A reference to multiple Object Classes that manage and provide the run time exchange of messages across DeviceNet.
- Application Objects _ A reference to multiple Object Classes that implement product specific features.

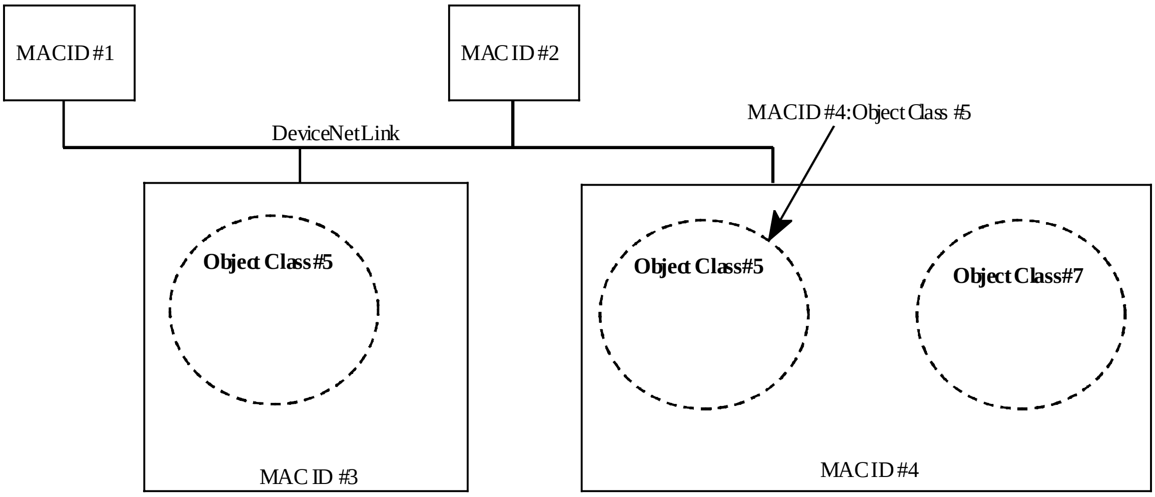
5.5. Object Addressing

The information in this section provides a common basis for logically addressing separate physical components across DeviceNet. The following list describes the information that is used to address an Object from DeviceNet:

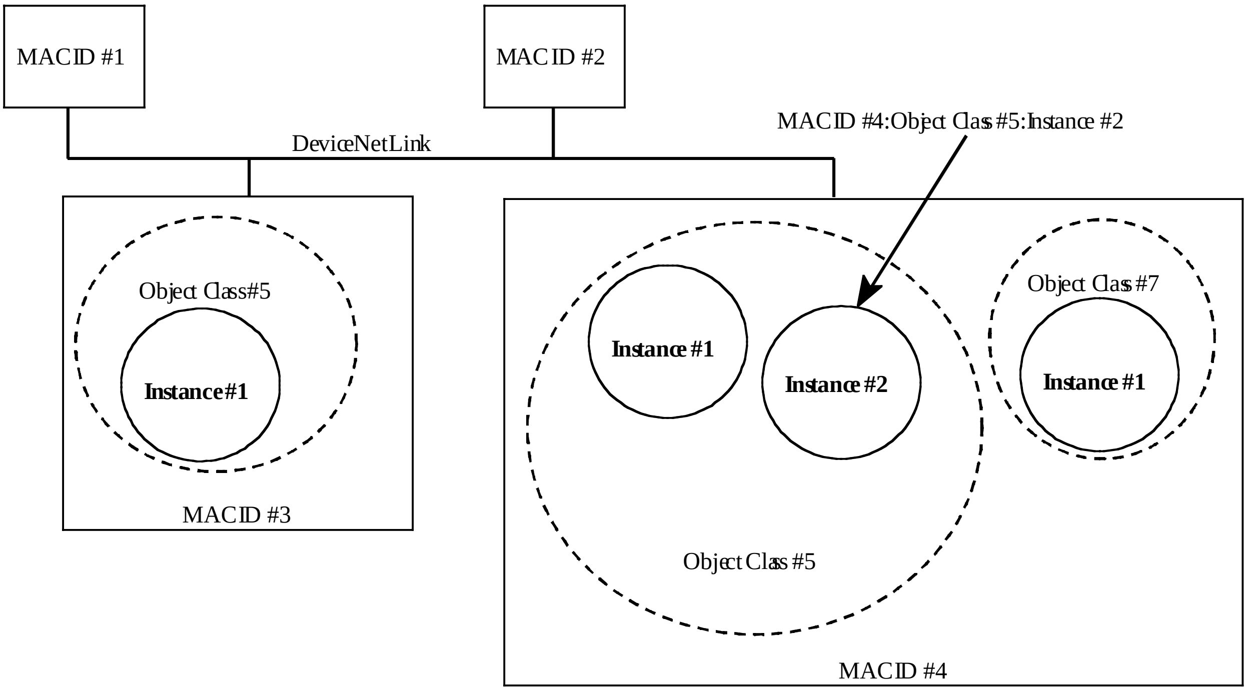
- Media Access Control Identifier (MAC ID) _ An integer identification value assigned to each node on DeviceNet. This value distinguishes a node among all other nodes on the same link.



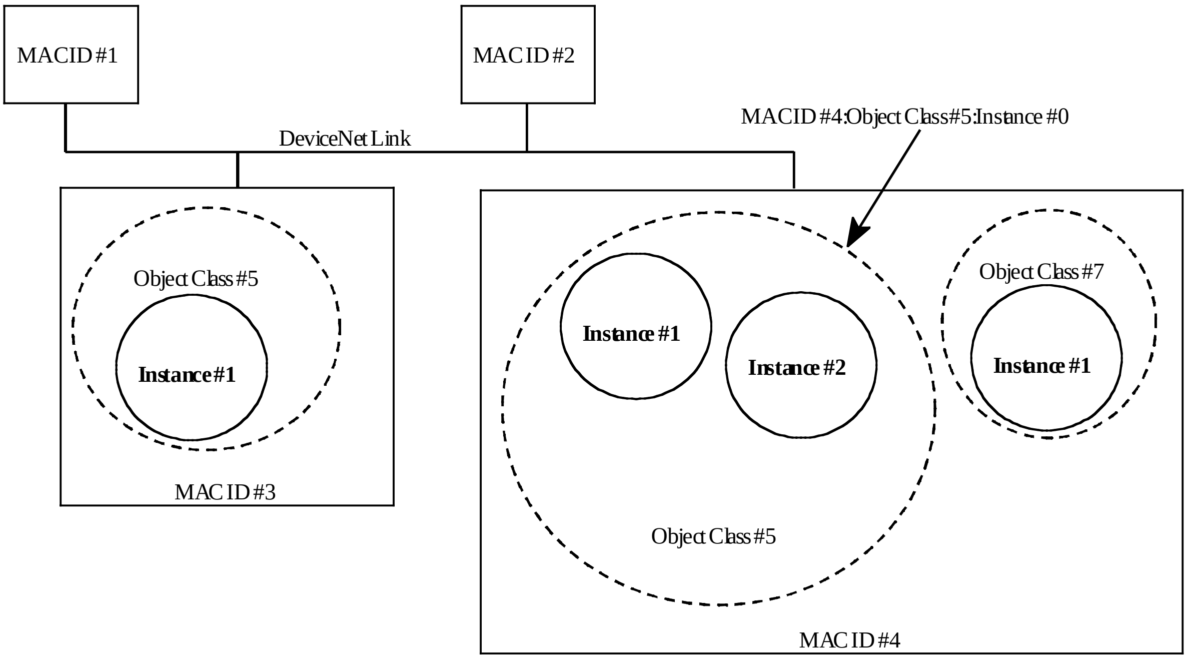
- Class Identifier (Class ID) _ An integer identification value assigned to each Object Class accessible from the network.



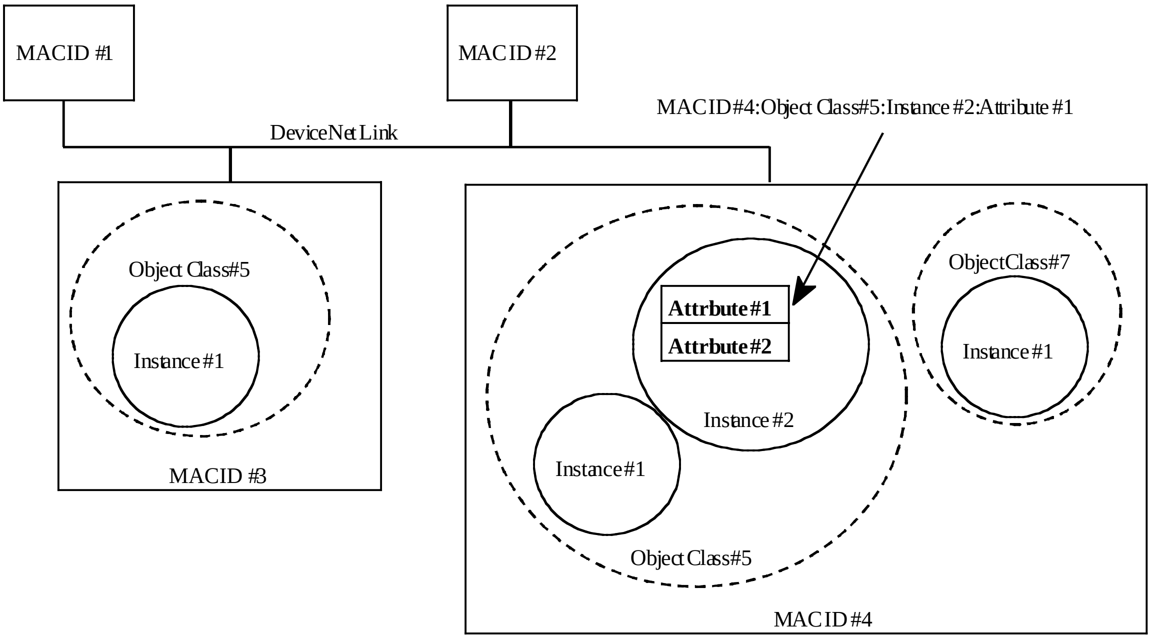
- Instance Identifier (Instance ID) _ An integer identification value assigned to an Object Instance that identifies it among all Instances of the same Class. This integer is unique within the MAC ID Class in which it resides.



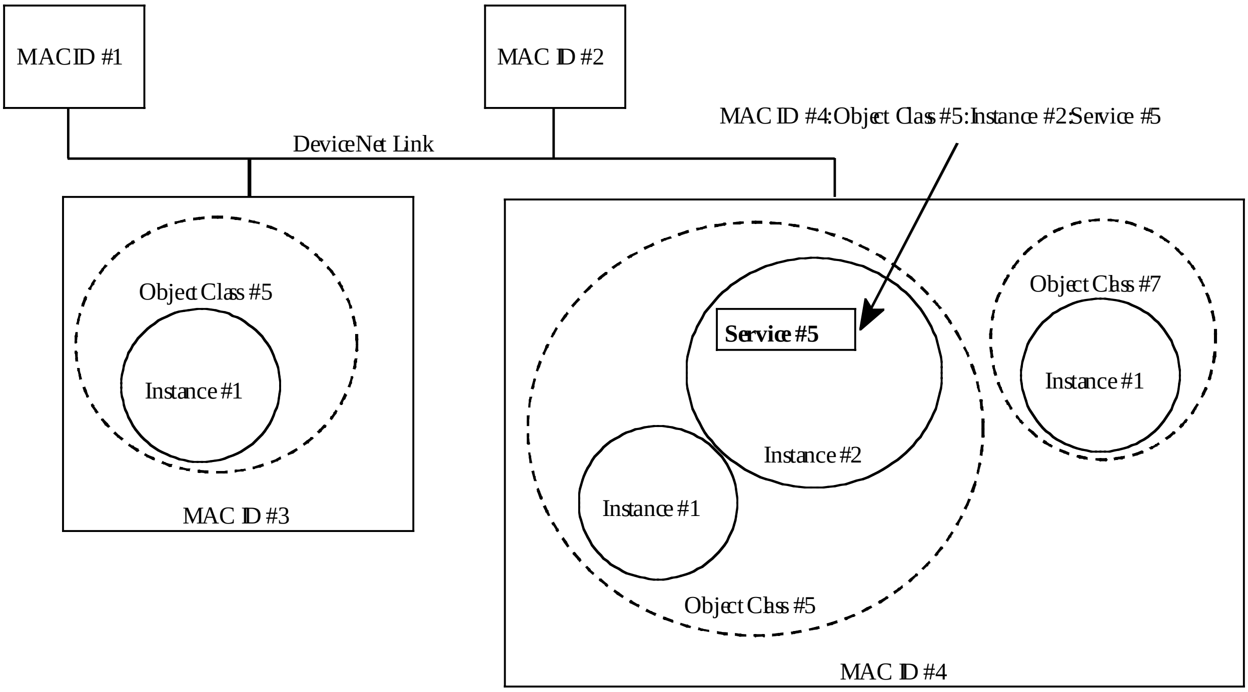
It is also possible to address the Class itself versus a specific Object Instance within the Class. This is accomplished by utilising the Instance ID value zero (0).
DeviceNet reserves the Instance ID value zero (0) to indicate a reference to the Class versus a specific Instance within the Class.



- Attribute Identifier (Attribute ID) _ An integer identification value assigned to a Class and/or Instance Attribute.



- Service Code _ An integer identification value which denotes a particular Object Instance and/or Object Class function.



5.6. Network overview

DeviceNet defines a connection based scheme to facilitate all application communications.
A DeviceNet connection provides a communication path between multiple end points.
The end points of a connection are applications that need to share data.
Transmissions associated with a particular connection are assigned an identification value when a connection is established. This identification value is called the Connection ID (CID).

Connection Objects model the communication characteristics of a particular application to application(s) relationship.
The term end_point refers to one of the communicating entities involved in a connection.

DeviceNet s connection based scheme defines a dynamic means by which the following two types of connections can be established:

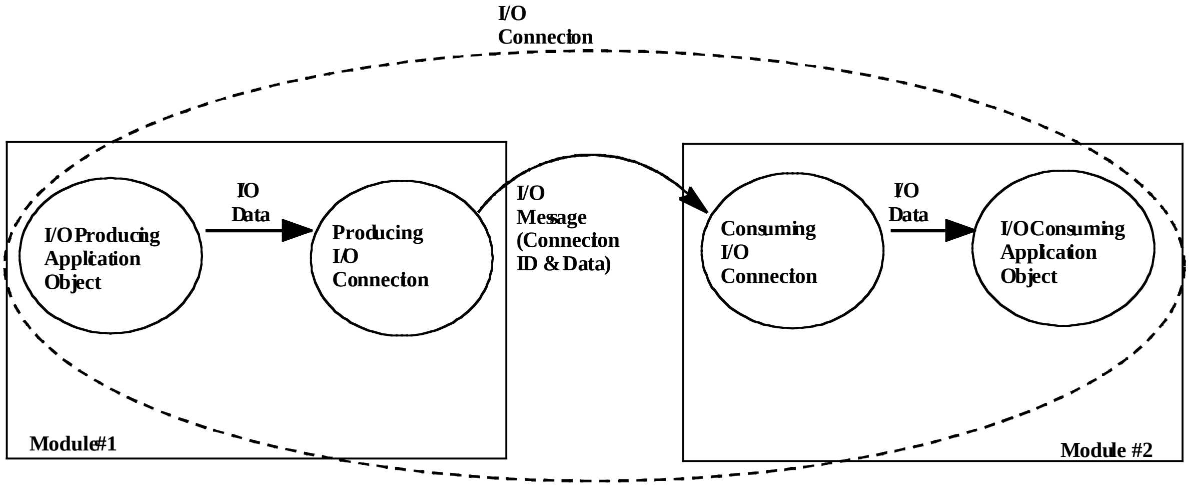
- I/O Connections _ Provide dedicated, special purpose communication paths between a producing application and one or more consuming applications.
  Application specific I/O data moves through these ports.
- Explicit Messaging Connections _ Provide generic, multi purpose communication paths between two devices. These connections often are referred to as just Messaging Connections.
  Explicit Messages provide the typical request/response oriented network communications.

The rules that govern the dynamic establishment of these connections are used as a foundation upon which a predefined set of Connections is defined.
These Connections facilitates the movement of data usually observed within Master/Slave relationships .

5.6.1. I/O Connections

As previously stated, I/O Connections provide special purpose communication paths between a producing application and one or more consuming applications.
Application specific I/O data moves across an I/O Connection.
I/O Messages are exchanged across I/O connections.
An I/O Message consists of a Connection ID and associated I/O data.
The meaning of the data within an I/O Message is implied by the associated Connection ID.
The connection end points are assumed to have knowledge of the intended use or meaning of the I/O Message.

DeviceNet I/O Connection

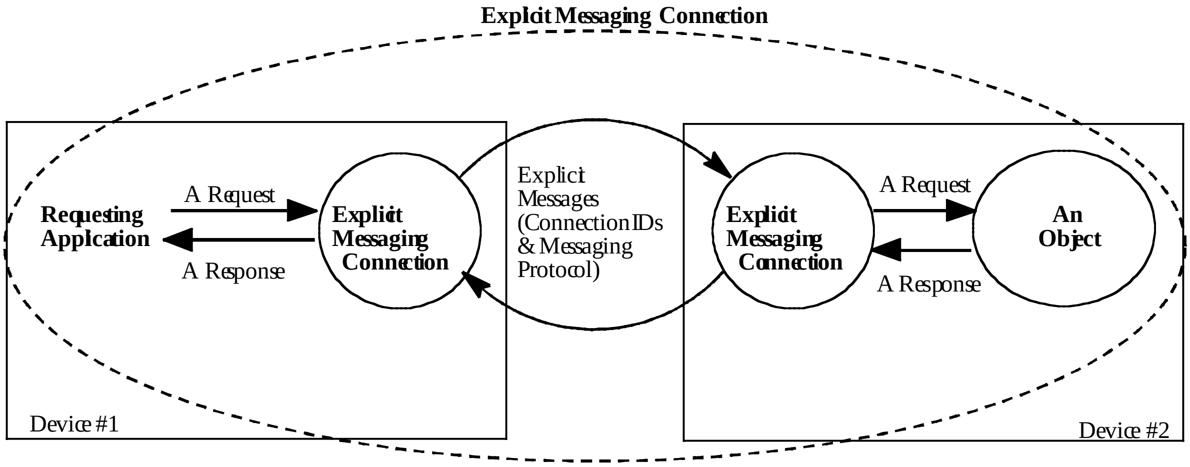

I/O Connecton
I/O Producing Application Object
IO Data
Producing I/O Connecton
I/O Message (Connecton ID & Data)
Consuming I/O Connecton
I/O Data
I/O Consuming Application Object
Module#1
Module #2

The Specification does not define any particular use for I/O Messaging. There are a wide variety of functions that can be accomplished using I/O Messaging.
Either by virtue of the particular type of product transmitting an I/O Message, or based upon configuration performed using Explicit Messaging, the meaning and/or intended use of all I/O Messages can be made known to the system.

5.6.2. Explicit Messaging Connections

Explicit Messaging Connections provide generic, multi purpose communication paths between two devices.
Explicit Messages are exchanged across Explicit Messaging Connections.
Explicit Messages are used to command the performance of a particular task and to report the results of performing the task.
The meaning/intended use of an Explicit Message is stated within the CAN Data Field.
Explicit Messaging provides the means by which typical request/response oriented functions are performed (e.g. module configuration).
DeviceNet defines an Explicit Messaging protocol that states the meaning of the message.
An Explicit Message consists of a Connection ID and associated messaging protocol information.

DeviceNet Explicit Messaging Connection


Explicit Messaging Connection
Requesting Application
A Request
A Response
Explicit Messaging Connection
Explicit Messages (Connection IDs & Messaging Protocol)
Explicit Messaging Connection
A Request
A Response
An Object
Device #1
Device #2

5.7. DeviceNet Object Model

Following Figure illustrates the abstract object model of a DeviceNet product. Included are the following components:

- Unconnected Message Manager (UCMM) _ Processes DeviceNet Unconnected Explicit messages (not used with the thyristor unit application).

- Connection Class_ Allocates and manages internal resources associated with both I/O and Explicit Messaging connections.

- Connection Object _ Manages the communication specific aspects associated with a particular application to application network relationship.

- DeviceNet Object _ Provides the configuration and status of a physical DeviceNet network connection.

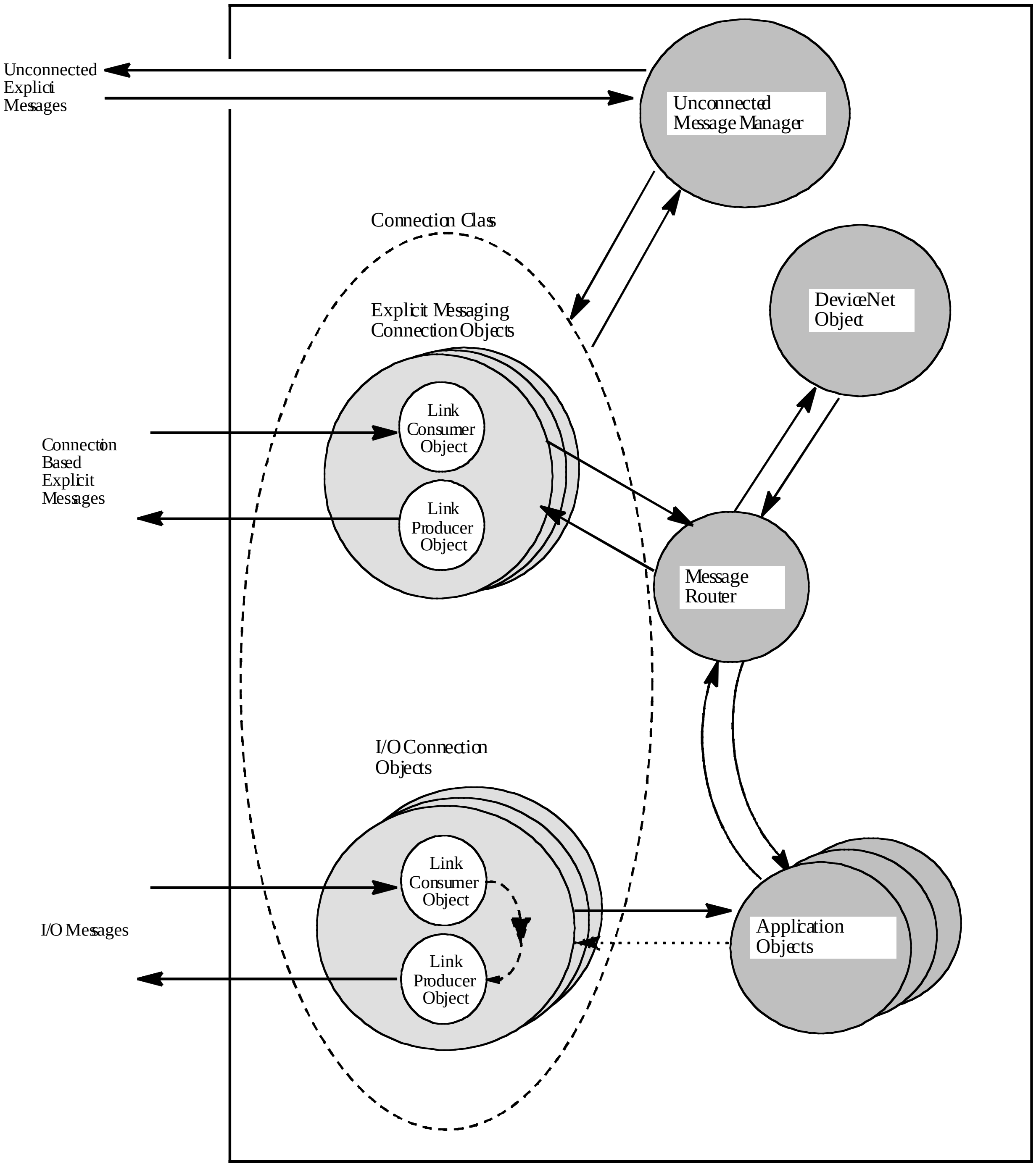
- Link Producer Object _ Used by a Connection Object to transmit data onto DeviceNet.

- Link Consumer Object _ Used by a Connection Object to receive data from DeviceNet.

- Message Router _ Distributes Explicit Request Messages to the appropriate handler object.

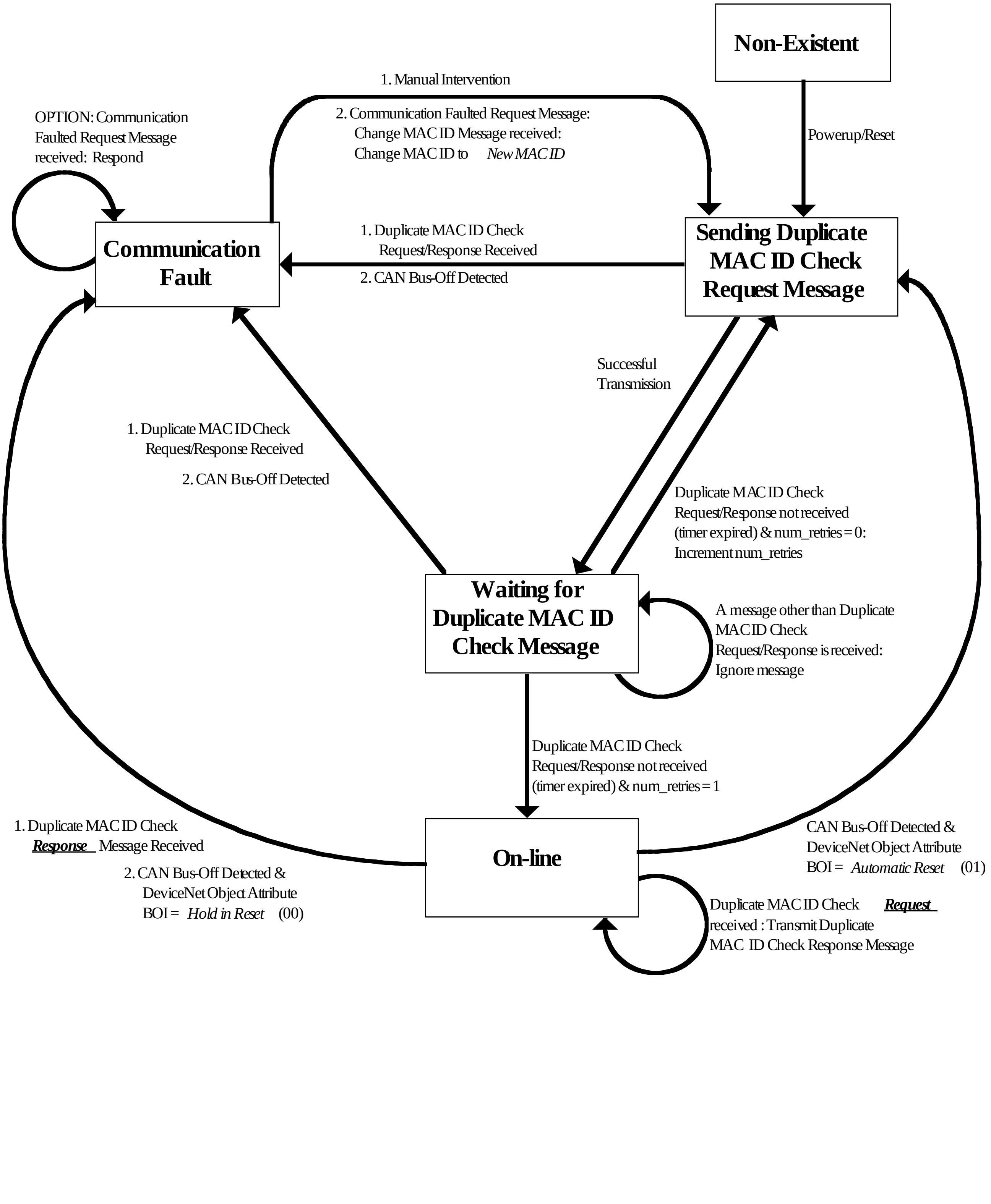
- Application Objects _ Implement the intended purpose of the product.

DeviceNet Module general Object Model



5.8. State transition diagram

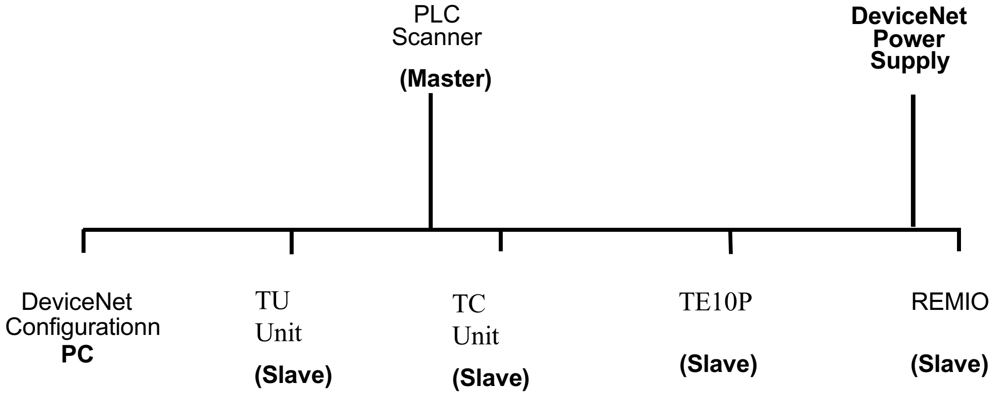
Following diagram shows the general behaviour of a DeviceNet process.


Non-Existent
Powerup/Reset
Sending Duplicate MAC ID Check Request Message
Communication Fault
Waiting for Duplicate MAC ID Check Message
On-line
1. Manual Intervention
2. Communication Faulted Request Message: Change MAC ID Message received: Change MAC ID to *New MAC ID*
OPTION: Communication Faulted Request Message received: Respond
1. Duplicate MAC ID Check Request/Response Received
2. CAN Bus-Off Detected
Successful Transmission
1. Duplicate MAC ID Check Request/Response Received
2. CAN Bus-Off Detected
Duplicate MAC ID Check Request/Response not received (timer expired) & num_retries = 0: Increment num_retries
A message other than Duplicate MAC ID Check Request/Response is received: Ignore message
Duplicate MAC ID Check Request/Response not received (timer expired) & num_retries = 1
1. Duplicate MAC ID Check ***Response*** Message Received
2. CAN Bus-Off Detected & DeviceNet Object Attribute BOI = *Hold in Reset* (00)
CAN Bus-Off Detected & DeviceNet Object Attribute BOI = *Automatic Reset* (01)
Duplicate MAC ID Check ***Request*** received : Transmit Duplicate MAC ID Check Response Message

5.9. The Predefined Master/Slave Connection Set

The preceding chapters presented the general model rules for establishing connections between devices.
The general model calls for the utilisation of an Explicit Messaging Connection to manually create and configure Connection Objects within each connection end point.
This chapter uses the general model as a basis for the definition of a set of connections which facilitate communications typically seen in a Master/Slave relationship.
These Connections are referred to collectively as the Predefined Master/Slave Connection Set.
The Master is the device that gathers and distributes I/O data for the process controller.
Slaves are the devices from which the Master gathers I/O data and to which the Master distributes I/O data.
The Master owns the Slaves whose MAC IDs appear in its scan list.
To determine with what Slaves it will communicate, the Master examines its scan list and sends commands accordingly.
Except for the Duplicate MAC ID Check, a Slave cannot initiate any communication before being told by the Master to do so.

Example DeviceNet Master/Slave Implementation:



Many of the steps involved in the creation and configuration of an Application to Application connection have been removed within the Predefined Master/Slave Connection Set definition.
This, in turn, presents the means by which a communication environment can be established using less network and device resources.

The following terms are used:

- Group 2 Server: A UCMM capable device that has been told to act as the Server for the Predefined Master/Slave Identifier Connections. See DeviceNet Slave.
- Group 2 Client: A device that has gained ownership of the Predefined Master/Slave Connection Set within a Server such that it can act as the Client on those connections. See DeviceNet Master.
- UCMM Capable Device: A device that supports the Unconnected Message Manager (UCMM). At minimum, this requires support for reception and processing of Unconnected Request Messages.
- UCMM Incapable Device: Typically a low—level device that, because of network interrupt management and first generation CAN chip screening capabilities, does not support the UCMM.

- Group 2 Only Server: A slave (server) device that is UCMM incapable and must use the Predefined Master/Slave Connection Set to establish communications (at a minimum, the Predefined Master/Slave Explicit Messaging Connection must be supported).
  A Group 2 Only device can transmit and receive only those identifiers defined by the Predefined Master/Slave Connection Set. (See Figure 7.2, Predefined Master/Slave Connection Set Identifier Fields.)

- Group 2 Only Client: A device that is acting as a Group 2 Client to a Group 2 Only Server. The Group 2 Only Client provides the UCMM functionality described in section 4-2.4 of DN specifications (UCMM Services) for Group 2 Only Servers that it has allocated.
  This concept is described in more detail later in this chapter.

- DeviceNet Master: Refers to a type of application called Master/Slave. The DeviceNet Master is the device that gathers and distributes I/O data for the process controller.
  A Master scans its Slave devices based on a scan list it contains. With respect to the network, the Master is a Group 2 Client or a Group 2 Only Client.

- DeviceNet Slave: Refers to a type of application called Master/Slave.
  A Slave returns I/O data to its Master when it is scanned. With respect to the network, the Slave is a Group 2 Server or a Group 2 Only Server.

- Predefined Master/Slave Connection Set: A set of Connections that facilitate communications typically seen in a Master/Slave relationship. Many of the steps involved in the creation and configuration of an Application to Application connection have been removed within the Predefined Master/Slave Connection Set definition. This, in turn, presents the means by which a communication environment can be established using less network and device resources.

5.9.1. Predefined Master/Slave Connection Set Messages

The CAN Identifier Fields associated with the Predefined Master/Slave Connection Set are shown bellow.
This table defines the Identifiers that are to be used with all connection based messaging involved in the Predefined Master/Slave Connection Set and, as such, it also illustrates produced_connection_id and consumed_connection_id attributes associated with Predefined Master/Slave Connection Objects.

IDENTIFIER BITS											IDENTITY USAGE	HEX Range
10	9	8	7	6	5	4	3	2	1	0		
0	Group 1 Message ID				Source MAC ID						group 1 Messages	000-3FF
0	1	1	0	1	Source MAC ID						Slave's I/O Change of state or Cyclic Message	
0	1	1	1	0	Source MAC ID						Slave's I/O Bit-Strobe response Message	
0	1	1	1	1	Source MAC ID						Slave's I/O Poll Response or Change of state/Cyclic Acknowledge Message	
1	0	MAC ID						Group 2 Message ID			group 2 Messages	400-5FF
1	0	Source MAC ID						0	0	0	Master's I/O Bit-Strobe Command message	
1	0	Source MAC ID						0	0	1	TBD	
1	0	Destination MAC ID						0	1	0	Master's Change of state or Cyclic Acknowledge Message	
1	0	Source MAC ID						0	1	1	Slave's Explicit / unconnected Response Message	
1	0	Destination MAC ID						1	0	0	Master's Explicit Request Messages	
1	0	Destination MAC ID						1	0	1	Master's I/O Poll Command/Change of state/Cyclic Message	
1	0	Destination MAC ID						1	1	0	Group 2 Only Unconnected Explicit Request Messages	
1	0	Destination MAC ID						1	1	1	Duplicate MACID Check Messages	

Important: Group 2, Message ID = 6 is reserved for use as the Group 2 Only Unconnected Explicit Request message port and should not be used for any other purpose.
The following types of messages are mentioned above in the table.

- I/O Bit—Strobe Command/Response Messages: The Bit—Strobe Command is an I/O Message that is transmitted by the Master.
  A Bit—Strobe Command Message has multi—cast capabilities. Multiple Slaves can receive and react to the same Bit_Strobe Command (multi—cast capabilities).
  The Bit—Strobe Response is an I/O Message that a Slave transmits back to the Master when the Bit—Strobe Command is received. Within a Slave, the Bit—Strobe Command and Response Messages are received/transmitted by a single Connection Object.
  Note: I/O Bit—Strobe Command is not used with our thyristor units.

- I/O Poll Command/Response Messages: The Poll Command is an I/O Message that is transmitted by the Master.
  A Poll Command is directed towards a single, specific Slave (point—to—point). A Master must transmit a separate Poll Command Message for each one of its Slaves that is to be polled.
  The Poll Response is an I/O Message that a Slave transmits back to the Master when the Poll Command is received. Within a Slave, the Poll Command and Response Messages are received/transmitted by a single Connection Object.

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

- Explicit Response/Request Messages: Explicit Request Messages are used to perform operations such as reading and writing attributes.
  Explicit Response Messages indicate the results of the attempt to service an Explicit Request Message. Within a Slave, Explicit Requests and Responses are received/transmitted by a single Connection Object.
  Note: Explicit Response/Request Messages are used with the thyristor unit for the Attribute Data exchange between the Master and the Slaves.

- Group 2 Only Unconnected Explicit Request Messages: The Group 2 Only Unconnected Explicit Request port is used to allocate/release the Predefined Master/Slave Connection Set. This port (Group 2, Message ID = 6) is reserved and should not be used for any other purpose.

- Group 2 Only Unconnected Explicit Response Messages: The Group 2 Only Unconnected Explicit Response port is used to respond to Group 2 Only Unconnected Explicit Request messages and to send Device Heartbeat / Device Shutdown messages. These messages are transmitted using the same identifier (Group 2, Message ID = 3) as an Explicit Response messages.

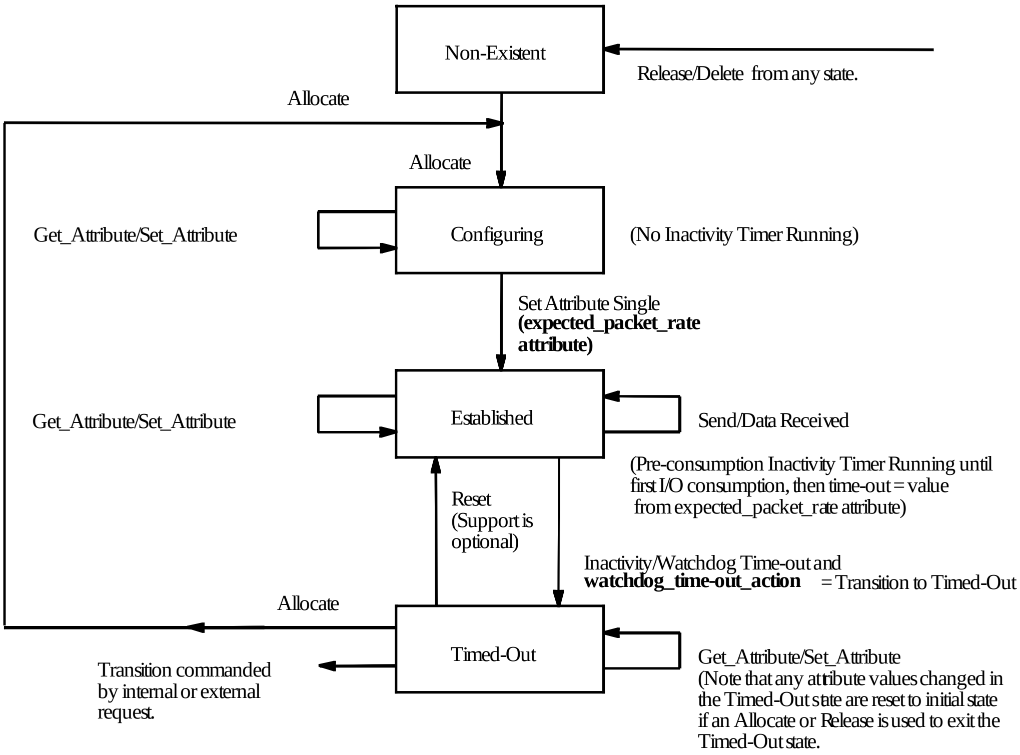
- Duplicate MAC ID Check Message: Each physical attachment to DeviceNet must be assigned a MAC ID.
  This configuration will involve human intervention, and it is inevitable that two modules on the same link will be assigned the same MAC ID.
  Because the MAC ID is involved in defining the meaning of a DeviceNet transmission, ALL DeviceNet modules are required to participate in a duplicate MAC ID detection algorithm.

Note that all but two of the messages associated with the Predefined Master/Slave Connection Set are transmitted across Message Group 2.

5.9.2. Predefined Master/Slave Connection Instance Behaviour

5.9.2.1.Predefined Master/Slave I/O Connection State Transition Diagram

(see chapter 6.2.6 for the particular implementation with thyristor units)


Non-Existent
Release/Delete from any state.
Allocate
Allocate
Get_Attribute/Set_Attribute
Configuring
(No Inactivity Timer Running)
Set Attribute Single
(expected_packet_rate
attribute)
Get_Attribute/Set_Attribute
Established
Send/Data Received
(Pre-consumption Inactivity Timer Running until
first I/O consumption, then time-out = value
from expected_packet_rate attribute)
Reset
(Support is
optional)
Inactivity/Watchdog Time-out and
watchdog_time-out_action = Transition to Timed-Out
Allocate
Timed-Out
Transition commanded
by internal or external
request.
Get_Attribute/Set_Attribute
(Note that any attribute values changed in
the Timed-Out state are reset to initial state
if an Allocate or Release is used to exit the
Timed-Out state.

Note that the Allocate and Release services send the connection instance back to initial state. All Connection Object attributes are reset to their default values.

Important: As far as attribute modification is concerned, Predefined Master/Slave I/O Connections must (at a minimum) support the modification of the expected_packet_rate attribute.

The SEM presented above provides a formal definition of the behaviour of I/O Connections within the Predefined Master/Slave Connection Set.

This SEM inherits from and/or overrides actions presented in the I/O Connection Object SEM.

Important: The State Event Machine presented above does not dictate rules with regards to product specific, internal logic.

Any attempt to access the Connection Class or a Connection Object Instance may need to pass through product specific verification.

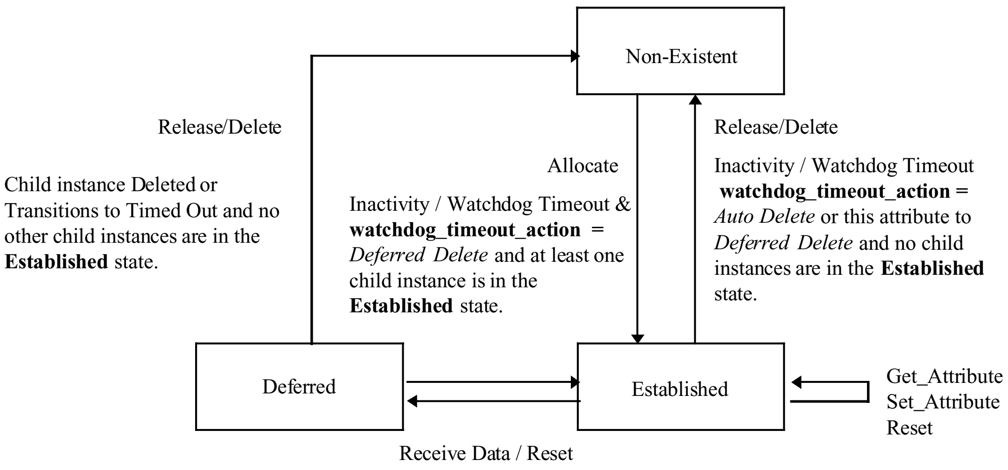
This may result in an error scenario that is not indicated by the SEM.

This may also result in additional, product specific indications delivered from a Connection Object to the application and/or a specific Application Object.

The point to remember is that the Predefined Master/Slave I/O Connection Object must exhibit the externally visible behaviour specified by the SEM above and the attribute definitions .

5.9.2.2. Predefined Master/Slave Explicit Messaging State Transition Diagram

(see chapter 6.2.6 for the particular implementation with thyristor units)


Non-Existent
Release/Delete
Child instance Deleted or Transitions to Timed Out and no other child instances are in the **Established** state.
Allocate
Inactivity / Watchdog Timeout & **watchdog_timeout_action** = *Deferred Delete* and at least one child instance is in the **Established** state.
Release/Delete
Inactivity / Watchdog Timeout **watchdog_timeout_action** = *Auto Delete* or this attribute to *Deferred Delete* and no child instances are in the **Established** state.
Deferred
Established
Get_Attribute
Set_Attribute
Reset
Receive Data / Reset

The SEM presented above provides a formal definition of the behaviour of the Explicit Messaging Connection within the Predefined Master/Slave Connection Set.
This SEM inherits from and/or overrides actions presented in the Explicit Messaging Connection Object SEM.

6. DEVICENET SPECIFICATION OF THE REMIO THYRISTOR INTERFACE

6.1. General

- The REMIO TE Series DeviceNet Interface operates as Group 2 only Predefined Master/Slave device following the DeviceNet Specifications Release 2.0.

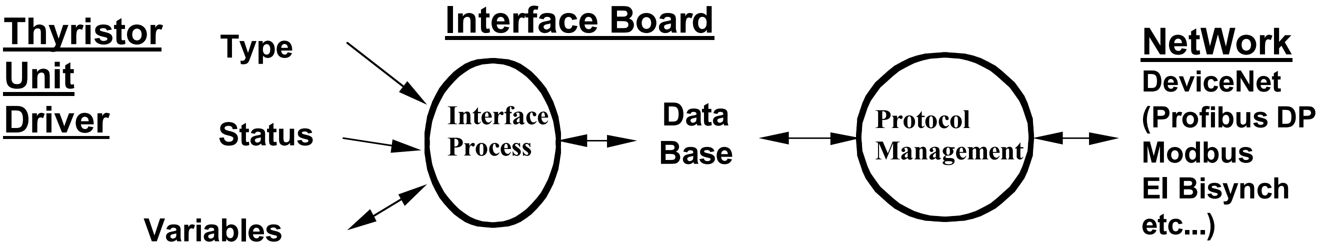
- Request and response using the Predefined Master/Slave Explicit Messaging Connection Set for random access to any parameters within the Data-Base.
- Global transfer of all the variables of the Device is possible through the Poll I/O Connection.

Note that the Fragmentation is supported by this Connection.

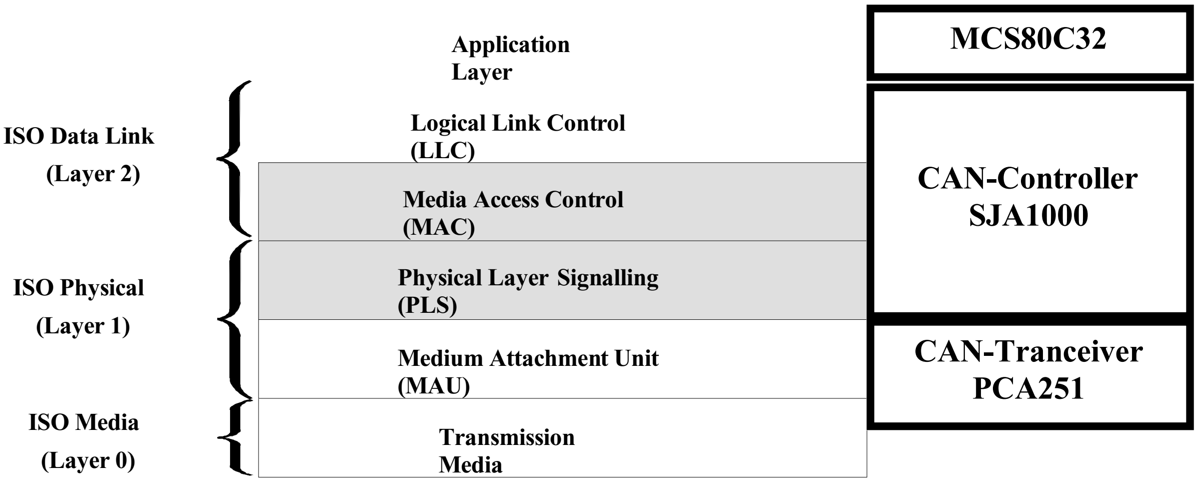
- The device does not support the Explicit Unconnected message Manager (UCMM).

Note: Because of the particular nature of this interface which can be used with different device of the EUROTHERM Thyristor Units, the Generic Device Profile (Type 0x00) defined in the volume 2 part 3 of the DeviceNet specifications has been used.

Architecture:



OSI-Layer Implementation:



- Identification Number given by ODVA: 45 (General Identifier for Eurotherm controls companies).

- Connection using standard shielded twisted pairs for the communication signal (CANH / CANL).

- Layer 1 and 2 of the OSI model controlled by a specific component: SJA1000 from Philips.

- Selection of the communication speed through 2 jumpers on the control board:
  125 kbauds, 250 kbauds, 500 kbauds.

- Address set by the BUS through the Explicit Messaging connection to the DeviceNet Object.

- Status indicated by LEDs:
  Module Status LED (MS).
  Network Status LED (NS).

- No redundancy available.

6.2. Device Profile

6.2.1. Device Type

Device type = Generic Device Class ID = 0x00
The Generic Device Type defines a device that does not fit into any of the defined device types.
The REMIO acts as the intelligent part between the DeviceNet network and the physical control of the thyristor unit.

6.2.2. General Object model:

6.2.2.1. DeviceNet Message Types

6.2.2.1.1. Received messages

As a group 2 slave device, the REMIO supports the following received message types across the Group 2.

Group	CAN Identifier Field	Group 2 Message Type
2	10xxxxxx111	Duplicate MACID Check messages
	10xxxxxx110	Unconnected Explicit Request messages
	10xxxxxx101	Master s I/O Poll Command
	10xxxxxx100	Master Explicit Request message

Note: xxxxxx = REMIO node Address.

6.2.2.1.2. Sent messages

2 other messages types will be sent from the Slave across the Group 1 or 2.

Group	CAN Identifier Field	Group 1 Message Type
1	01111xxxxxx	Slave I/O Poll Response
2	10xxxxxx011	Slave Explicit Response message

6.2.2.2.DeviceNet Services

As a Group 2 Slave Device, the REMIO TE Series interface supports the following Class Services and Instance Services.

Service name	Service code
Reset	0x05
Get_Attribute_Single	0x0E
Set_Attribute_Single	0x10
Allocate_Group2_Identifier_Set	0x4B
Release_Group2_Identifier_Set	0x4C

6.2.2.3. Error codes

When the Device has detected an error in the Master Request, an error code is issued in the response.

6.2.2.3.1.General Error Service Code

0x14

6.2.2.3.2. Common Error codes

Error Identification	Error code
Resource Unavailable	0x02
Service Not Supported	0x08
Invalid Attribute Value	0x09
Already in State	0x0B
Object state Conflict	0x0C
Attribute Not settable	0x0E
Access Denied	0x0F
Device State conflict	0x10
Data Too Large	0x11
Not Enough Data	0x13
Attribute not Supported	0x14
Too much data	0x15
Object not existent	0x16
No Stored attribute	0x18
Store Failed	0x19
Vendor Specific	0x1F
Invalid Parameter	0x20

6.2.2.3.3.Class specific errors Codes (additional)

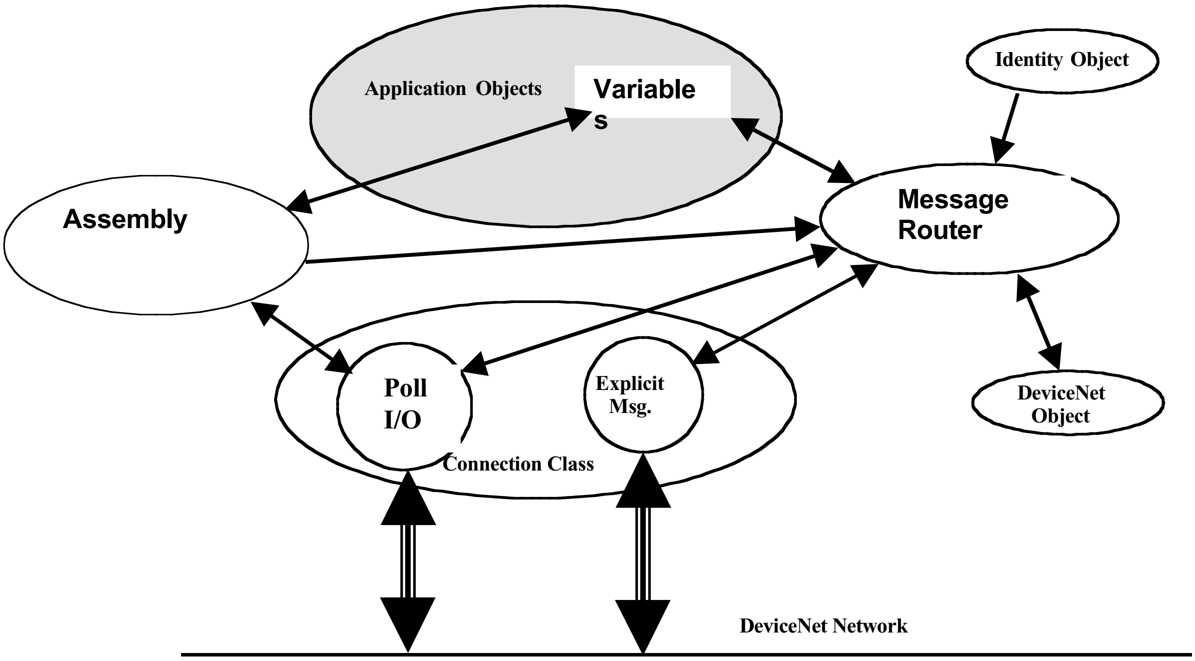
Error Identification	Error code
Allocation Conflict	0x01
Invalid Allocation	0x02
Invalid Unconnect Request	0x03
Resource Not Available	0x04
No Additional Code	0xFF

6.2.2.4.DeviceNet Object Classes

The REMIO TE Series interface supports the following DeviceNet object classes.

Class	Object Class	# of instances
0x01	Identity	1
0x02	Message Router	1
0x03	DeviceNet	1
0x04	Assembly	1
0x05	Connection	2 = (1 Explicit Messaging + 1 Poll I/O)
0x64	Thyristor Unit Variable	Depends on the REMIO Configuration

6.2.2.5.Global model of the REMIO Thyristor Interface:



6.2.3. Identity Object

6.2.3.1.Class Code

Class Code = 01.

6.2.3.2.Class attributes

None instanciated.

6.2.3.3.Number of instance:

Number of instance = 1

6.2.3.4.Instance attributes:

Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
1	Get	Vendor	UINT	45
2	Get	Device Type	UINT	0x00
3	Get	Device Code	UINT	Device_Code
4	Get	Revision Major Revision Minor Revision	Structure of: USINT USINT	2 1
5	Get	Status	WORD	Device_Status
6	Get	Serial Number	UDINT	Unique 32 bit number
7	Get	Product Name	STRING[5]	

- Vendor:

Vendor IDs are managed by the Open DeviceNet Vendor Association, Inc. (ODVA). Number 45 (0x2D) has been attributed for all the Eurotherm Products.

- Device_Type:

The list of device types is managed by ODVA. It is used to identify the device profile that a particular product is using.
Device profiles define minimum requirements a device must implement as well as common options.
A listing of the presently defined Device Types can be found on volume 2 chapter 3 of DeviceNet specifications.
The Generic Device Type defines a device that does not fit into any of the defined device types.

- Device_Code:

The Device codes are the way for identifying a particular product driven from this interface. It permits to select the right variable table.
Codes are attributed as follows:

Product	Code
REMIO BASIC	0x01
REMIO 16*TPO	0x02
REMIO 32*TPO	0x03
REMIO 48*TPO	0x04

- Device_Status:

This attribute represents the current status of the entire device. Its value changes as the state of the device changes. The Status attribute is a WORD, with the following bit definitions:
Bit Definitions for Status Instance Attribute of Identity Object:

Bit (s):	Called:	Definition
0	Owned	TRUE indicates the device has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/Slave Connection Set has been allocated to a master
1		Reserved, set to 0
2	Configured	TRUE indicates the application of the device has been configured to do something different than the out—of—box default. This does not include configuration of the communications.
3,4,5, 6,7		reserved, set to 0
8	Minor Recoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be recoverable. The problem does not cause the device to go into one of the faulted states.
9	Minor Unrecoverable	TRUE indicates the device detected a problem with itself, which Fault is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states.
10	Major Recoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the Major Recoverable Fault state.
11	Major Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the Major Unrecoverable Fault state.
12,13, 14,15		Reserved, set to 0

- Serial Number:

The Serial Number is a 32 bits unique number for all products from any single vendor ID (Eurotherm is 45). It is constituted as follows:

AA xx xx xx

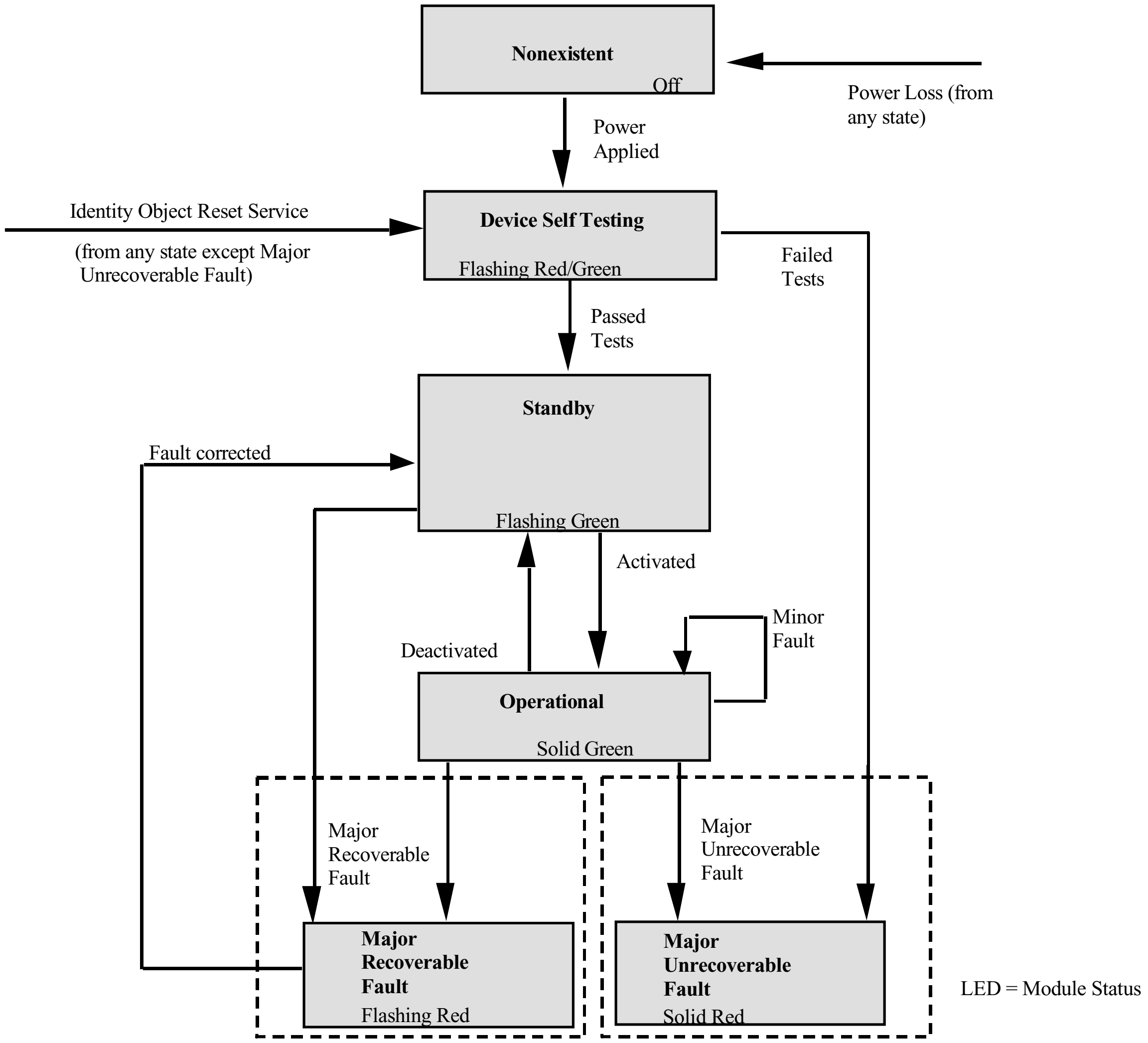
Where AA is always 64 (0x40) for the REMIO
And xx xx xx a sequential Number given at the production time.

- Product Name:

The Product Name depends on the Product code.

Product	Code	Name
REMIO BASIC	0x01	REMIO
REMIO 16*TPO	0x02	REM16
REMIO 32*TPO	0x03	REM32
REMIO 48*TPO	0x04	REM48

6.2.3.5 State transition diagram



6.2.3.6.Common Services:

Service Code	Service Name
0x0E	Get_Attribute_Single
0x05	Reset

6.2.4. DeviceNet Object

6.2.4.1.Class Code

Class code = 0x03

6.2.4.2.Class attributes

Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
1	Get	Revision	UINT	2

6.2.4.3.Number of instance

Number of Instance = 1

6.2.4.4.Instance attributes

Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
1	Get/Set	Node Address	USINT	0-63
2	Get	Baud Rate	USINT	Dip Switch setting
5	Get	Allocation Information	Struct of:	
		Choice byte	BYTE	0x00 (at power on) 0x03 (2 cnx allocated)
		Allocator s MACID	USINT	0-63 (allocated) 255 (not allocated)

- Node Address = MAC ID:

This attribute contains the MAC ID of this device. The range of values is 0 to 63 decimal. The Device is delivered with the Address 32 (0x20). this Address must be changed before any operation.

- Baud Rate:

The Baud Rate attribute indicates the selected baud rate

Value	Meaning
00	125 kbauds
01	250 kbauds
02	500 kbauds

- Allocation Information:

The Allocation Information attribute is pertinent to the Predefined Master/Slave Connection Set. It indicates whether or not the Predefined Master/Slave Connection Set defined in vol 1 Chapter 7 of the specifications has been allocated.
If it has been allocated, then, this attribute indicates the device that has performed the allocation and the Connection(s) that are currently allocated.
This attribute is modified when a successful response associated with an Allocate_Master/Slave_Connection_Set service is generated.
This attribute is not modifiable by the Set_Attribute_Single Service.
An Error Response whose General Error Code Field is set to 0Ehex (Attribute not settable) is returned if a Set_Attribute_Single request specifies this attribute.
The Allocation Information attribute consists of the following:

_ Allocation Choice Byte:

The Allocation Choice byte indicates which of the Predefined Master/Slave Connections are active (in the Configuring, or Established state). Its format is as follows:

7	6	5	4	3	2	1	0
Reserved	Ack Suppression	Cyclic	Change of State	Reserved	Bit Strobed	Polled	Explicit Message

The Allocation Choice byte is initialised to 00 at device power—up, and then fixed by the allocation procedure of the predefined Connection Set Allocate (Message Gr 2 ID 6).

_ Master s MAC ID:

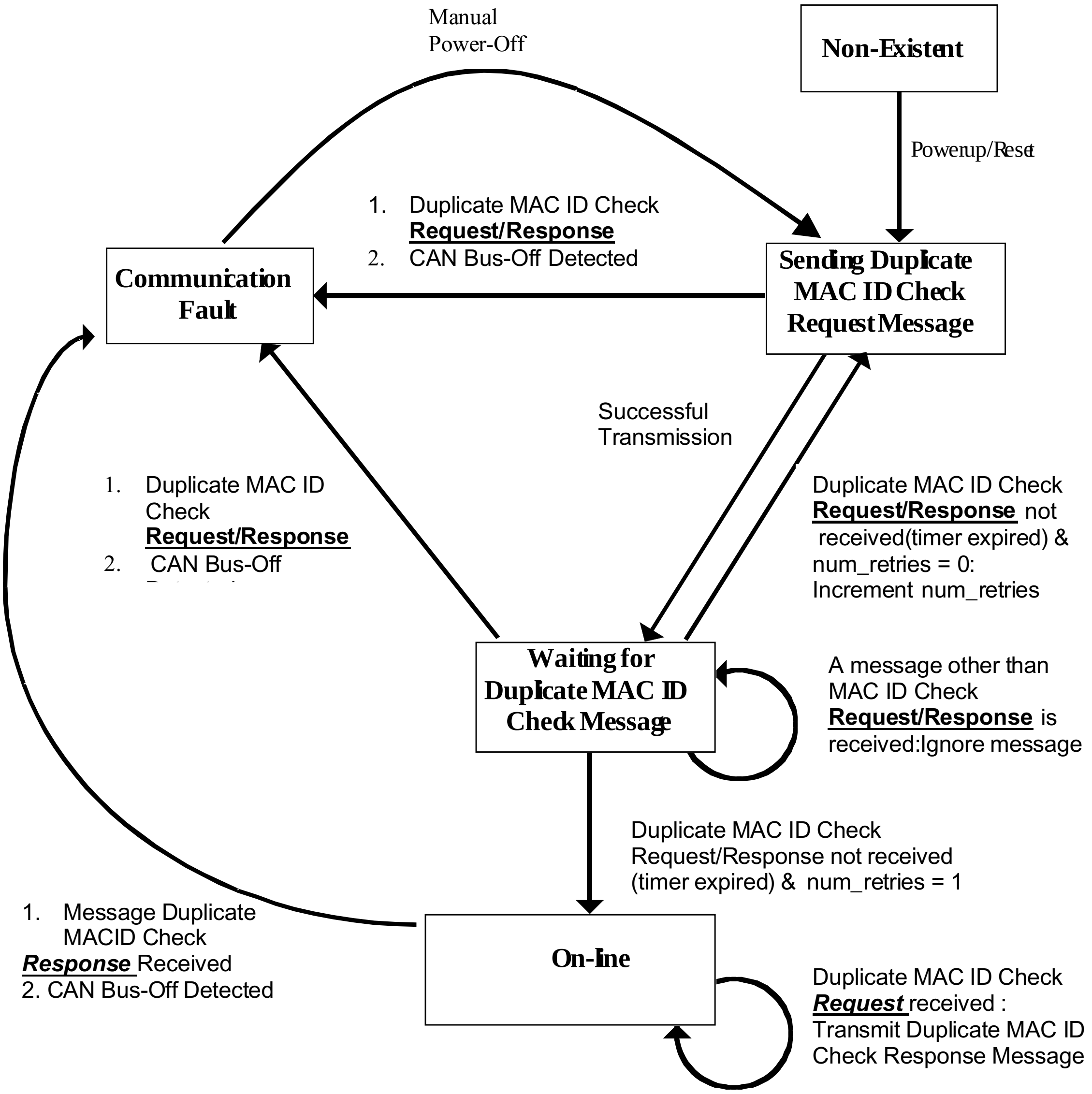
The Master s MAC ID contains the MAC ID of the device that has allocated the Predefined Master/Slave Connection Set via the Allocate_Master/Slave_Connection_Set service. This contains the Allocator s MAC ID field copied from the Allocate_Master/Slave_Connection_Set request.
The range of values is 0 to 63 and 255 decimal.
A value in the range 0—63 indicates that the Predefined Master/Slave Connection Set is currently allocated and denotes the MAC ID of the device that performed the allocation.
The value 255 means the Predefined Master/Slave Connection set has not been allocated.
The Master s MAC ID attribute is initialised to 255 (FF hex) at device power—up/reset.

6.2.4.5.Common Services:

Service Code	Service Name
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single
0x4B	Allocate_Master/Slave_Connection_Set
0x4C	Release_Master/Slave_Connection_Set

6.2.4.6.State transition diagram

Note that the general diagram presented in chap. 2.8 is simplified


Manual
Power-Off
Non-Existent
Powerup/Reset
1. Duplicate MAC ID Check Request/Response
2. CAN Bus-Off Detected
Communication Fault
Sending Duplicate MAC ID Check Request Message
Successful Transmission
1. Duplicate MAC ID Check Request/Response
2. CAN Bus-Off
Duplicate MAC ID Check Request/Response not received(timer expired) & num_retries = 0: Increment num_retries
Waiting for Duplicate MAC ID Check Message
A message other than MAC ID Check Request/Response is received:Ignore message
Duplicate MAC ID Check Request/Response not received (timer expired) & num_retries = 1
1. Message Duplicate MACID Check Response Received
2. CAN Bus-Off Detected
On-line
Duplicate MAC ID Check Request received : Transmit Duplicate MAC ID Check Response Message

6.2.5. Assembly Object

6.2.5.1.Class Code

Class Code = 0x04

6.2.5.2.Class attributes

Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
1	Get	Revision	UINT	2

6.2.5.3.Number of instance

Number of instances = 1

6.2.5.4.Instance attributes

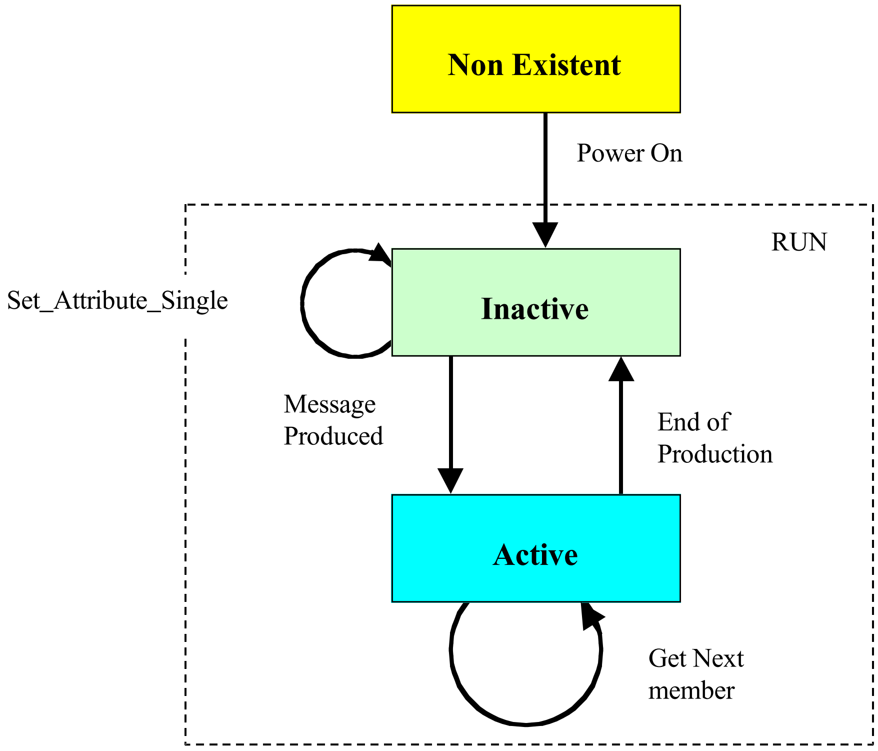
Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
3	Get	Data	Array	0-255

Data return 6 bytes which are image of the 6 ports.

6.2.5.5.Common Services:

Service Code	Service Name
0x0E	Get_Attribute_Single

6.2.5.6.Behavior of the Static Assembly



6.2.6. Connection Object

6.2.6.1.Class Code

Class Code = 0x05

6.2.6.2.Class attributes

None instanciated.

6.2.6.3.Number of instance

Number of instances = 2.

Instance Identifiers are attributed as follows:

Connection Instance ID	Description
1	Explicit Messaging
2	Poll I/O Connection

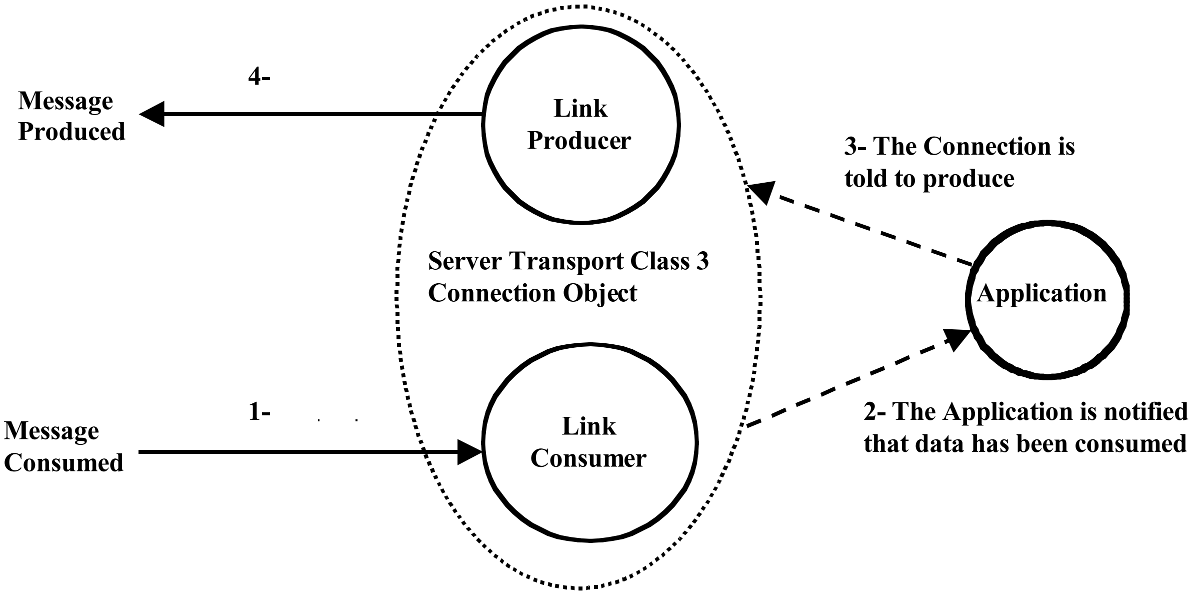
6.2.6.4. Instance 1 (Explicit Message Connection)

6.2.6.4.1Instance 1 attributes

Attribute ID	Access Rule	Name	Device Net Data type	Data Value
1	Get	State	USINT	0 = Non Existent 3 = Established 5 = Deferred Delete
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	BYTE	0x83
4	Get	Produced Connection ID	UINT	10xxxxxx011b xxxxxx = node address
5	Get	Consumed Connection ID	UINT	10xxxxxx100b xxxxxx = node address
6	Get	Initial Comm Characteristics	BYTE	0x21
7	Get	Produced Connection Size	UINT	7
8	Get	Consumed Connection Size	UINT	7
9	Get/Set	Expected Packet Rate	UINT	2500 (default value in ms)
12	Get	Watchdog Time Out Action	USINT	1 = autodelete
13	Get	Produced Connection Path Length	UINT	0
14	Get	Produced Connection Path		No data
15	Get	Consumed Connection Path Length	UINT	0
16	Get	Consumed Connection Path		No data

- Transport Class Trigger = 0x83 _

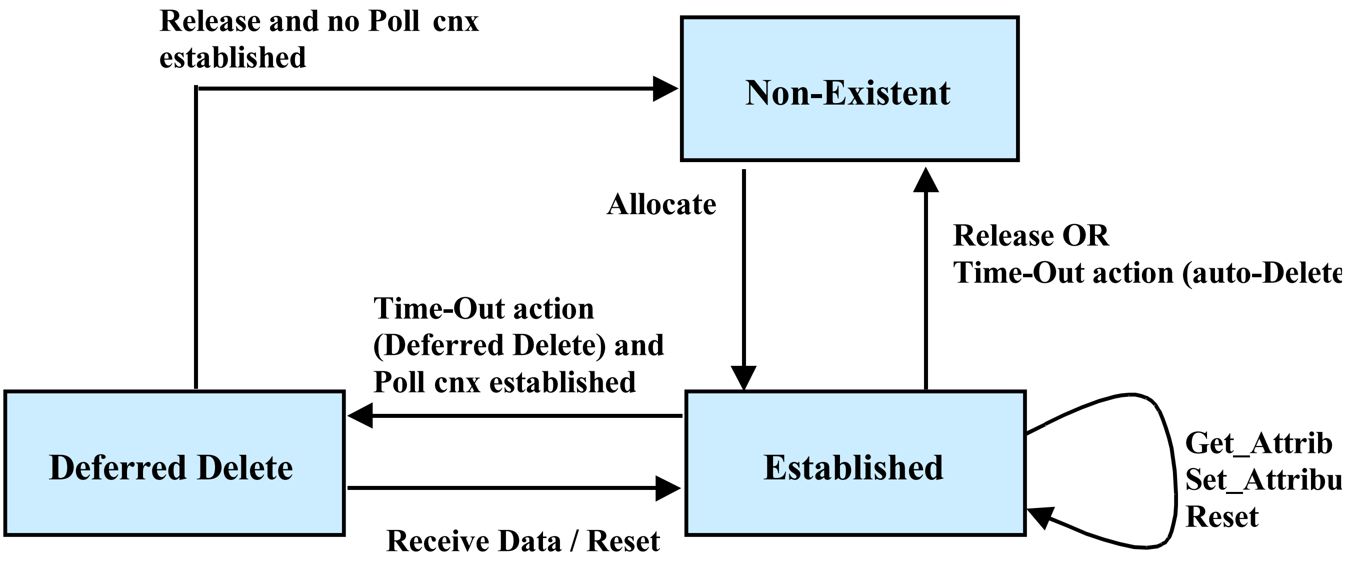
This end-point acts as a Server
The Production Trigger is Cyclic
Transport Class 3: When the Link Consumer receives a message, it delivers it to the Application Object specified within the consumed_connection_path attribute.
The Application Object then validates this receive data event (see figure below).
If the Application Object determines that the receive data event is valid, then it is REQUIRED to trigger a production as illustrated below


4-
Message Produced
Link Producer
3- The Connection is told to produce
Server Transport Class 3 Connection Object
Application
1-
Message Consumed
Link Consumer
2- The Application is notified that data has been consumed

- Initial Comm Characteristics = 0x21 _

Produce across Message Group 2 (Source)
Consume a Group 2 Message (Destination)

6.2.6.4.2. Instance 1 (explicit Cnx) State Transition Diagram


Release and no Poll cnx established
Non-Existent
Allocate
Release OR
Time-Out action (auto-Delete
Time-Out action (Deferred Delete) and Poll cnx established
Deferred Delete
Established
Get_Attrib
Set_Attribu
Reset
Receive Data / Reset

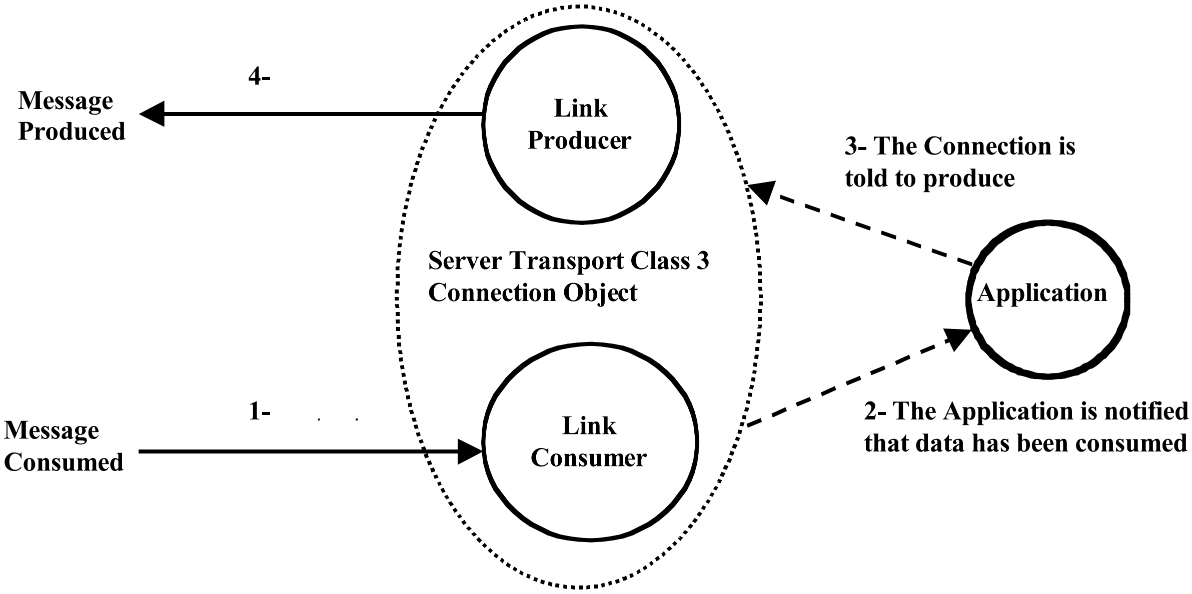
6.2.6.5. Instance 2 (Poll I/O Connection) attributes

6.2.6.5.1 Instance 2 Attributes

Attribute ID	Access Rule	Name	DeviceNet Data type	Data Value
1	Get	State	USINT	0 = Non Existent 1 = Configuring 3 = Established 4 = Timed Out
2	Get	Instance Type	USINT	1 = I/O Message
3	Get	Transport Class Trigger	BYTE	0x83
4	Get	Produced Connection ID	UINT	01111xxxxxxb xxxxxx = node address
5	Get	Consumed Connection ID	UINT	10xxxxxx101b xxxxxx = node address
6	Get	Initial Comm Characteristics	BYTE	0x01
7	Get	Produced Connection Size	UINT	Depends on the Device Code
8	Get	Consumed Connection Size	UINT	Depends on the Device Code
9	Get/Set	Expected Packet Rate	UINT	0 (default value in ms) must be configured
12	Get	Watchdog Time Out Action	USINT	0 = Transition to Timed-Out
13	Get	Produced Connection Path Length	UINT	0x04
14	Get	Produced Connection Path	USINT[4]	0x20 = logic segm, Class ID 0x04 = Assembly class ID 0x24 = logic segm, Attr ID 0x01 = first variable ID
15	Get	Consumed Connection Path Length	UINT	0x04
16	Get	Consumed Connection Path	USINT[4]	0x20 = logic segm, Class ID 0x04 = Assembly class ID 0x24 = logic segm, Attr ID 0x01 = first variable ID

- Transport Class Trigger = 0x83

This end-point acts as a Server
The Production Trigger is Cyclic
Transport Class 3: When the Link Consumer receives a message, it delivers it to the Application Object specified within the consumed_connection_path attribute.
The Application Object then validates this receive data event (see figure below).
If the Application Object determines that the receive data event is valid, then it is REQUIRED to trigger a production as illustrated below


4-
Message Produced
Link Producer
3- The Connection is told to produce
Server Transport Class 3 Connection Object
Application
1-
Message Consumed
Link Consumer
2- The Application is notified that data has been consumed

- Initial Comm Characteristics = 0x01 indicates that the slave s Poll I/O Connection produce across Message group 1 and consumes across message group 2. This value also indicates that the Slave s MACID appears in the CAN Identifier Field of the Group 2 Message that the Slave will consume.

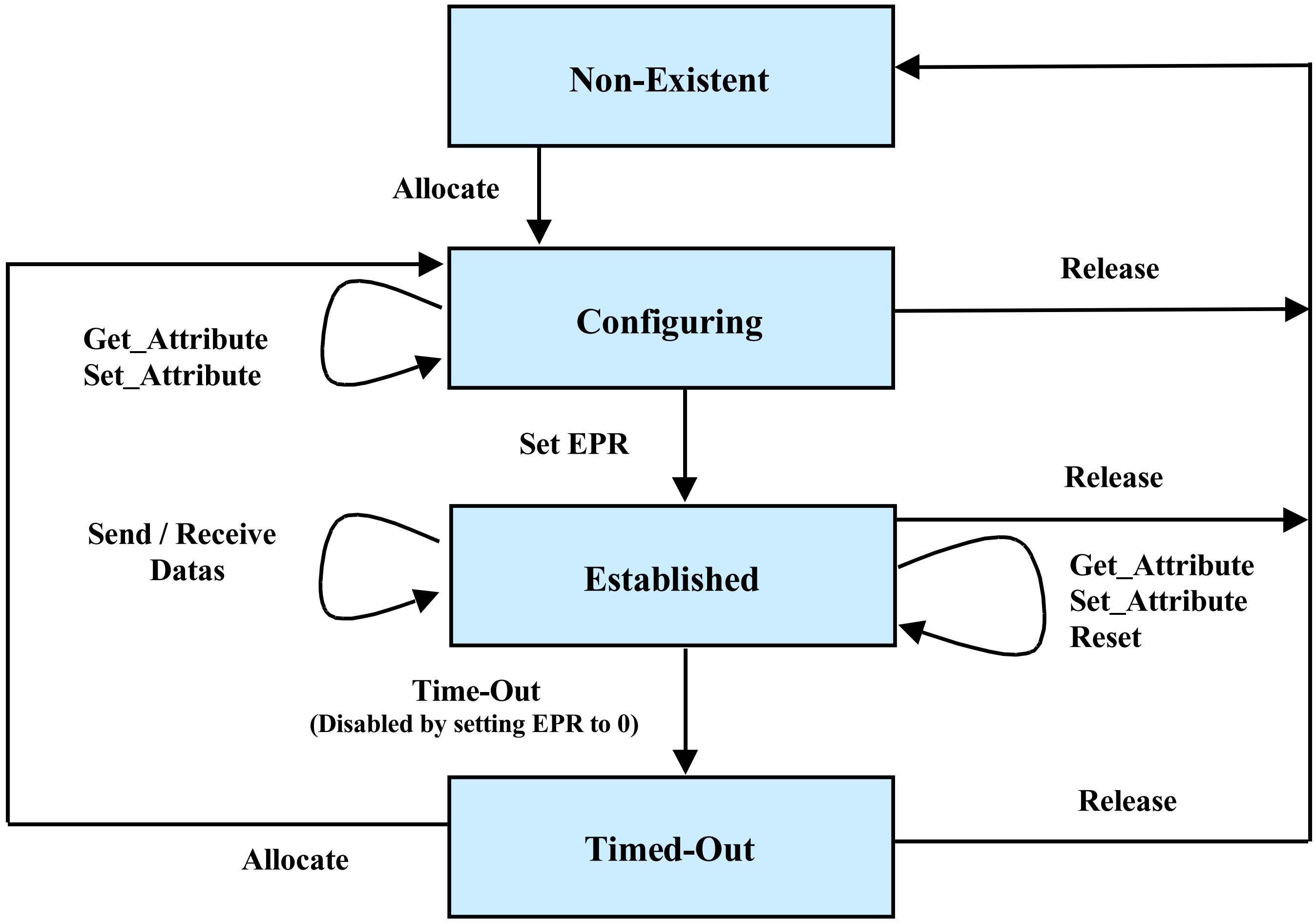
- Expected Packet Rate: The default value is 0, then the time-out is de-activated. If the value is not zero, then the connection is automatically producing Status/Diag of the Unit at the end of the time out. This value has to be configured by the Master.
  It is required to initialise this value, even if it remain to 0.

- Produced Connection Size and Consumed Connection Size determine if the Fragmentation protocol will be used or not by the IO Poll Connection.
  The Size depends on the Device Code (configuration) of the REMIO.
  The Unit Type is read from the Identity object (Device_Code = attribute #3)
  Codes are attributed as follows:

Product	Code	Connection Size	Fragmentation
REMIO BASIC	0x00	6	No
REMIO 16*TPO	0x01	22	Yes
REMIO 32*TPO	0x02	38	Yes
REMIO 48*TPO	0x03	54	Yes

In the case of the REMIO Basic, the Fragmentation Protocol is not used because the Size is less than 8 bytes. In the other cases, the fragmentation protocol is used.

6.2.6.5.2 Instance 2 (Poll I/O Cnx) State Transition Diagram



6.2.6.6. Common Services:

Service Code	Service Name
0x05	Reset
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

6.2.7. REMIO Variable Object

The REMIO Variable Object is the way for read or write a particular variable in the Data Base of the REMIO.
As the number of values depends on the particular configuration addressed, the number of instance depends as well on the configuration.
All the attributes (value) of each instance (variable) are accessed (Read or Write) through the Explicit Message Connection or through the Fragmented Poll I/O connection.

6.2.7.1. Class Code

Class Code = 0x64
This Class Code is Vendor specific.

6.2.7.2.Class attributes:

None instanciated.

6.2.7.3.Number of instance.

Depends on the Device Code (configuration) of the REMIO.
The Unit Type is read from the Identity object (Device_Code = attribute #3)
Codes are attributed as follows:

Product	Code	Number of Instances
REMIO BASIC	0x00	6
REMIO 16*TPO	0x01	22
REMIO 32*TPO	0x02	38
REMIO 48*TPO	0x03	54

6.2.7.3.1. Common variables to all Device Codes

Instance ID	description	Data Type	Attribute values	Attribute Access Rule
1	Port 1	USINT	0-255	GET/SET
2	Port 3	USINT	0-255	GET/SET
3	Port 5	USINT	0-255	GET/SET
4	Port 2	USINT	0-255	GET/(SET)
5	Port 4	USINT	0-255	GET/(SET)
6	Port 6	USINT	0-255	GET/(SET)

Note: Ports 1, 3, 5 are output only (Readable and writable)
Ports 2, 4, 6 are Get/Set if SW1.1=OFF, but Get only if SW1.1=ON

Instance ID	description	Data Type	Attribute values	Attribute Access Rule
100	Command_Word	UINT	-	GET/SET*
101	Serial_Number	UINT	-	SET*

important: Writing these 2 parameters is reserved for the production line. DO NOT ATTEMPT TO CHANGE IT.

Command_Word (CW) reflect the configuration of the Device as follows:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n.u	n.u	n.u	n.u	X	X	X	X	n.u	n.u	n.u	n.u	n.u	n.u	n.u	X

n.u. = not used
bit0 = 0_ Direct Logic Bit0 = 1_ Inverted Logic
bit8 = 1_ basic TPO module 1 fit
bit9 = 1_ TPO module 1fit
bit10 = 1_ TPO module 2 fit
bit11 = 0_ SW1.1=OFF Bit11 = 1_ SW1.1=ON

6.2.7.3.2. REMIO 16*TPO

Same as above, +following Instances:

Instance ID	description	Data Type	Attribute values	Attribute Access Rule
7	TPO 1-1	USINT	0-255	GET/SET
8	TPO 1-2	USINT	0-255	GET/SET
9	TPO 1-3	USINT	0-255	GET/SET
10	TPO 1-4	USINT	0-255	GET/SET
11	TPO 1-5	USINT	0-255	GET/SET
12	TPO 1-6	USINT	0-255	GET/SET
13	TPO 1-7	USINT	0-255	GET/SET
14	TPO 1-8	USINT	0-255	GET/SET
15	TPO 1-9	USINT	0-255	GET/SET
16	TPO 1-10	USINT	0-255	GET/SET
17	TPO 1-11	USINT	0-255	GET/SET
18	TPO 1-12	USINT	0-255	GET/SET
19	TPO 1-13	USINT	0-255	GET/SET
20	TPO 1-14	USINT	0-255	GET/SET
21	TPO 1-15	USINT	0-255	GET/SET
22	TPO 1-16	USINT	0-255	GET/SET

6.2.7.3.3 REMIO 32*TPO

Same as above, +following Instances:

Instance ID	description	Data Type	Attribute values	Attribute Access Rule
23	TPO 2-1	USINT	0-255	GET/SET
24	TPO 2-2	USINT	0-255	GET/SET
25	TPO 2-3	USINT	0-255	GET/SET
26	TPO 2-4	USINT	0-255	GET/SET
27	TPO 2-5	USINT	0-255	GET/SET
28	TPO 2-6	USINT	0-255	GET/SET
29	TPO 2-7	USINT	0-255	GET/SET
30	TPO 2-8	USINT	0-255	GET/SET
31	TPO 2-9	USINT	0-255	GET/SET
32	TPO 2-10	USINT	0-255	GET/SET
33	TPO 2-11	USINT	0-255	GET/SET
34	TPO 2-12	USINT	0-255	GET/SET
35	TPO 2-13	USINT	0-255	GET/SET
36	TPO 2-14	USINT	0-255	GET/SET
37	TPO 2-15	USINT	0-255	GET/SET
38	TPO 2-16	USINT	0-255	GET/SET

6.2.7.3.4 REMIO 48*TPO

Same as above, +following Instances:

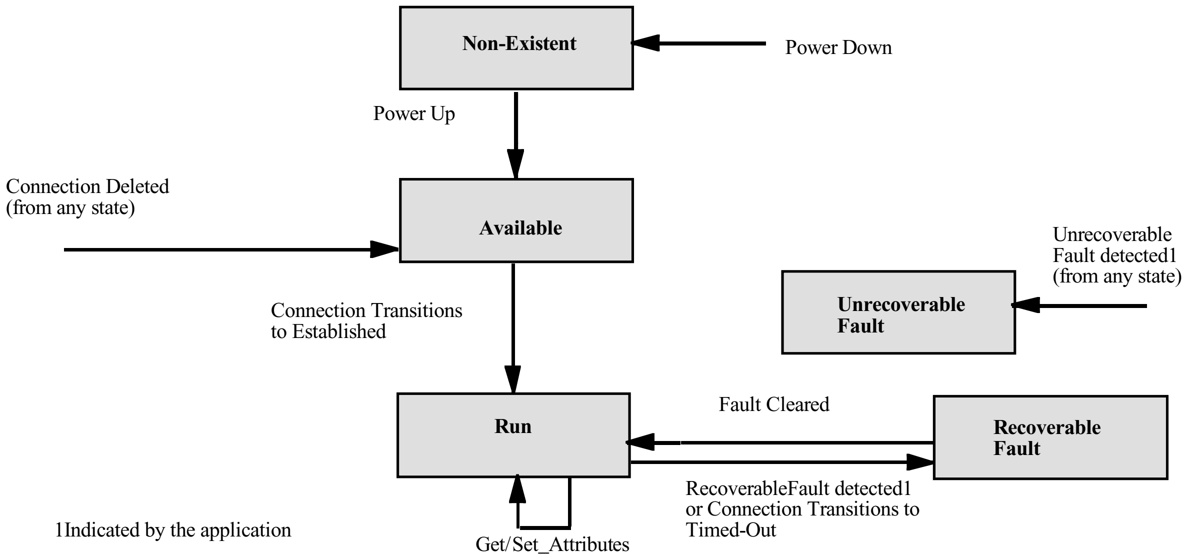
Instance ID	description	Data Type	Attribute values	Attribute Access Rule
39	TPO 3-1	USINT	0-255	GET/SET
40	TPO 3-2	USINT	0-255	GET/SET
41	TPO 3-3	USINT	0-255	GET/SET
42	TPO 3-4	USINT	0-255	GET/SET
43	TPO 3-5	USINT	0-255	GET/SET
44	TPO 3-6	USINT	0-255	GET/SET
45	TPO 3-7	USINT	0-255	GET/SET
46	TPO 3-8	USINT	0-255	GET/SET
47	TPO 3-9	USINT	0-255	GET/SET
48	TPO 3-10	USINT	0-255	GET/SET
49	TPO 3-11	USINT	0-255	GET/SET
50	TPO 3-12	USINT	0-255	GET/SET
51	TPO 3-13	USINT	0-255	GET/SET
52	TPO 3-14	USINT	0-255	GET/SET
53	TPO 3-15	USINT	0-255	GET/SET
54	TPO 3-16	USINT	0-255	GET/SET

6.2.7.4.Instance Attribute:

Attribute ID	Access Rule	Name	Device Net Data type	Data Value
1	See above	Value	USINT	See above

6.2.7.5.Behaviour

The State Transition Diagram below provides a graphical description of the events and corresponding state transitions.



Non-Existent
Power Down
Power Up
Connection Deleted (from any state)
Available
Unrecoverable Fault detected1 (from any state)
Unrecoverable Fault
Connection Transitions to Established
Fault Cleared
Run
Recoverable Fault
RecoverableFault detected1 or Connection Transitions to Timed-Out
1Indicated by the application
Get/Set_Attributes

Important: Events can occur simultaneously, but the Fault events have priority if they occur simultaneously with other events.

6.2.7.6.Common Services:

Service Code	Service Name
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

6.3. Scope of Class attributes access rules

Class	Class ID	Instance ID	Services
Identity	0x01	0x01	Get_Attribute_Single Reset
DeviceNet	0x03	0x01	Get_Attribute_Single Allocate_Master/Slave_Connection_Set Release_Master/Slave_Connection_Set
Assembly	0x04	0x03	Get_Attribute_Single
Expl Connection	0x05	0x01	Get_Attribute_Single Set_Attribute_Single Reset
Poll I/O Connection	0x05	0x02	Get_Attribute_Single Set_Attribute_Single Reset
Message Router	0x02	0x01	
REMIO Variable	0x64	0x01	Get_Attribute_Single Set_Attribute_Single

7. NETWORK INSTALLATION

Before to start a DeviceNet system, it must be assigned an unmatched address to each station (MAC ID). In the case of the REMIO, this address is set Through the link.
Remember than:
Only addresses 0 to 63 can be used in normal operation with a Master (as defined in the DeviceNet specifications).

7.1. Physical Connection

The Communication electronics is isolated from the Control electronics.

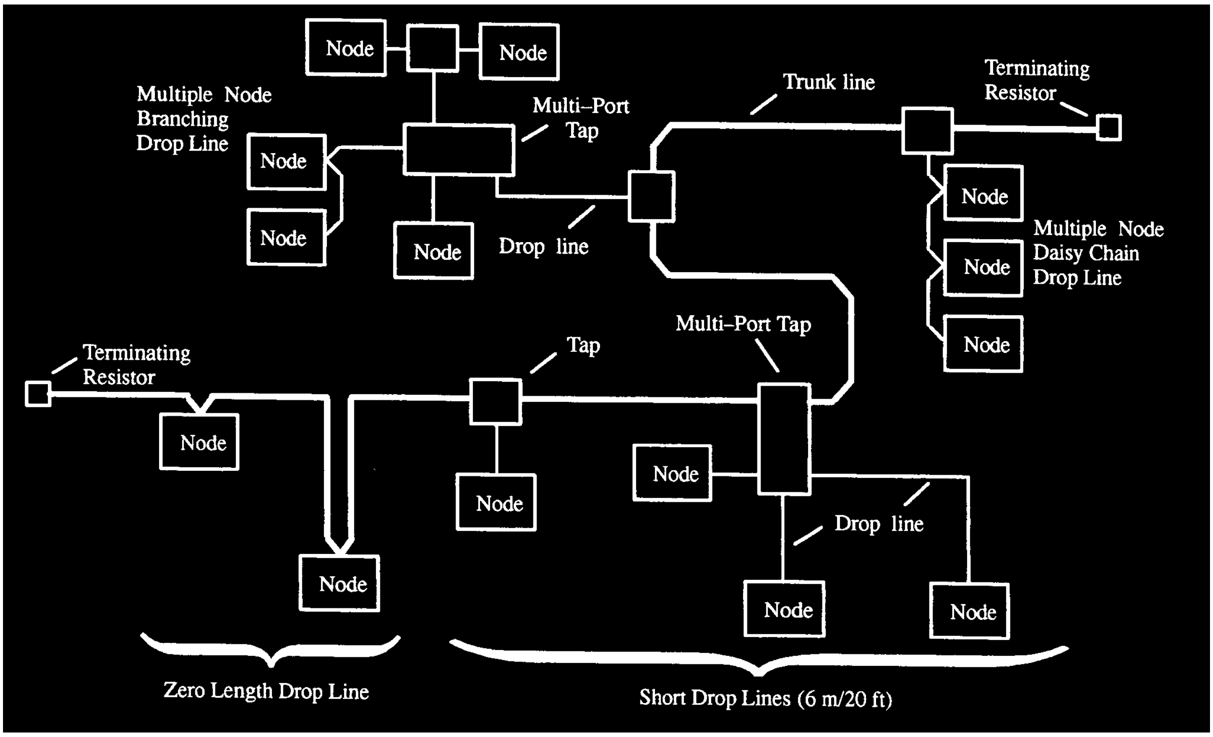
7.1.1. Transmission Media

The following sections describe the characteristics of the Transmission Media for DeviceNet. The DeviceNet trunk line _ drop line topology can be constructed of either DeviceNet Thick Cable or DeviceNet Thin Cable, or a combination of both. Thick Cable allows long trunk line distances and more sturdy trunk lines or drop lines. Thin Cable provides easier routing and termination of either trunk lines or drop lines.

7.1.1.1. Topology

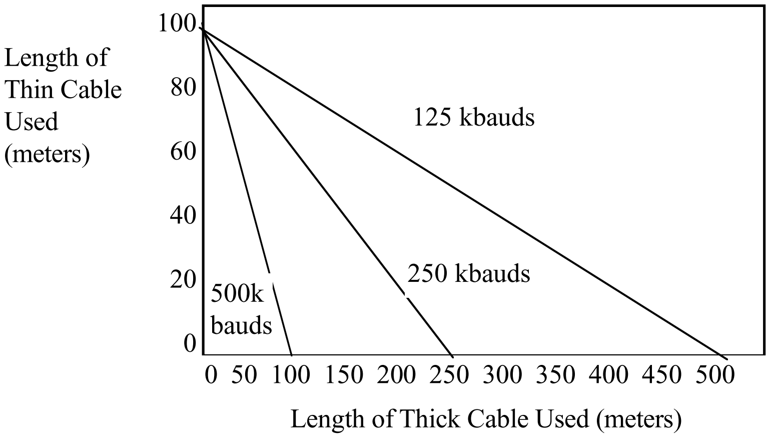
The DeviceNet media has a linear bus topology.
Terminating resistors are required on each end of the trunk line. Drop lines as long as 6 m (20 feet) each are permitted, allowing one or more nodes to be attached.
DeviceNet allows branching structures only on the drop line. For information about the power delivery capability on the trunk line and drop line refer to Chapter 10 of the DeviceNet specifications.

The total amount of trunk line allowable on the network depends upon the data rate and the type of cable (thick or thin) used.
The cable distance between any two points in the cable system must not exceed the Maximum Cable Distance allowed for the baud rate.
For trunk lines constructed of only one type of cable, refer to following Table to determine the Maximum Cable Distance based on the data rate and the type of cable used.
Cable distance between two points includes both trunk line cable length and drop line cable length that exists between the two points.



Maximum Cable Distance

Data Rate	Maximum Cable Distance for 100 % Thick Cable	Maximum Cable Distance for100 % Thin Cable
125 kbauds	500 meters (1640 ft.)	100 meters (328 ft.)
250 kbauds	250 meters (820 ft.)	
500 kbauds	100 meters (328 ft.)	



$L_{thick} + 5 \text{ x } L_{thin} = 500$ at 125 kbauds
$L_{thick} + 2.5 \text{ x } L_{thin} = 250$ at 250 kbauds
$L_{thick} + L_{thin} = 100$ at 500 kbauds

where L_{thick} is the length of thick cable and Lthin is the length of thin cable.

DeviceNet allows the use of either thick or thin cable to be used to construct trunk lines.
DeviceNet also allows a combination of both types of cable to be used on the same network.
To determine the maximum cable distance with a mix of both thick and thin cable, use following diagram.
For power restrictions with a mix of both types of cable, see section 10.2 of the DeviceNet specifications.
Drop line length is the longest cable distance of those measured from the tap on the trunk line to each of the transceivers of the nodes on the drop line.
This distance includes any drop line cable which might be permanently attached to the device.
The total amount of drop line allowable on the network depends upon the data rate.
Refer to the following drop line budget when determining the number and length of drop lines.

Data Rate	Drop Length	
	Maximum	Cumulative
125 kbauds	6 meters (20 ft)	156 meters (512 ft.)
250 kbauds		78 meters (256 ft.)
500 kbauds		39 meters (128 ft.)

7.1.1.2.Thick Cable

This cable consists of two shielded pairs twisted on a common axis with a drain wire in the centre covered with an overall braid shield and is commonly used as trunk line when length is important.
Listed below are general requirements for the DeviceNet Thick Cable.
Other types of external insulation and/or jacketing are allowable provided that internal construction and electrical characteristics adhere to the cable specifications.
See Appendix B, DeviceNet Cable Specifications for details.

- One twisted signal pair (#18); blue/white
- One twisted power pair (#15); black/red
- Separate aluminised mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#18); bare*
- High speed (Vp = 75% min), low loss, low distortion, data pair (to keep propagation delays to a minimum)
- 8 amp maximum current capacity
- PVC insulation on power pair
- Industrial temperature range
- High flexibility

*The drain wire connects the shields within the cable and serves as a means to terminate the shield into the connector.

7.1.1.3. Thin Cable

Thin Cable is smaller and more flexible than Thick Cable.
It is commonly used for drop lines, but can also be used, for shorter distances, as trunk line.
Listed below are general requirements for the DeviceNet Thin Cable.
Other types of external insulation and/or jacketing are allowable provided that internal construction and electrical characteristics adhere to the cable specifications.
See Appendix B, DeviceNet Cable Specifications for details.

- One twisted signal pair (#24); blue/white
- One twisted power pair (#22); black/red
- Separate aluminised mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#22); bare*
- High speed (Vp = 75% min.), low loss, low distortion, data pair (to keep propagation delays minimum)
- 3 amp maximum current capacity
- PVC insulation on power pair
- Industrial temperature range
- High flexibility

*The drain wire connects the shields within the cable and serves as a means to terminate the shield into the connector.

7.1.1.4. Terminating Resistors

DeviceNet requires a terminating resistor to be installed at each end of the trunk. The resistor requirements are:

- 121 ohms
- 1 % Metal Film
- 1/4 W

Important: Terminating resistors should never be included in nodes.

Inclusion of this capability could easily lead to a network with improper termination (too high or too low an impedance) potentially causing failure.
For example, removal of a node which includes a terminating resistor could result in network failure.

Important: Terminating resistors should not be installed at the end of a drop line, only at the two ends of the trunk line.

7.1.1.5. Connectors: Wire colors and pin out

All connectors must support five conductors, which accommodate a signal pair, power pair, and a drain wire.

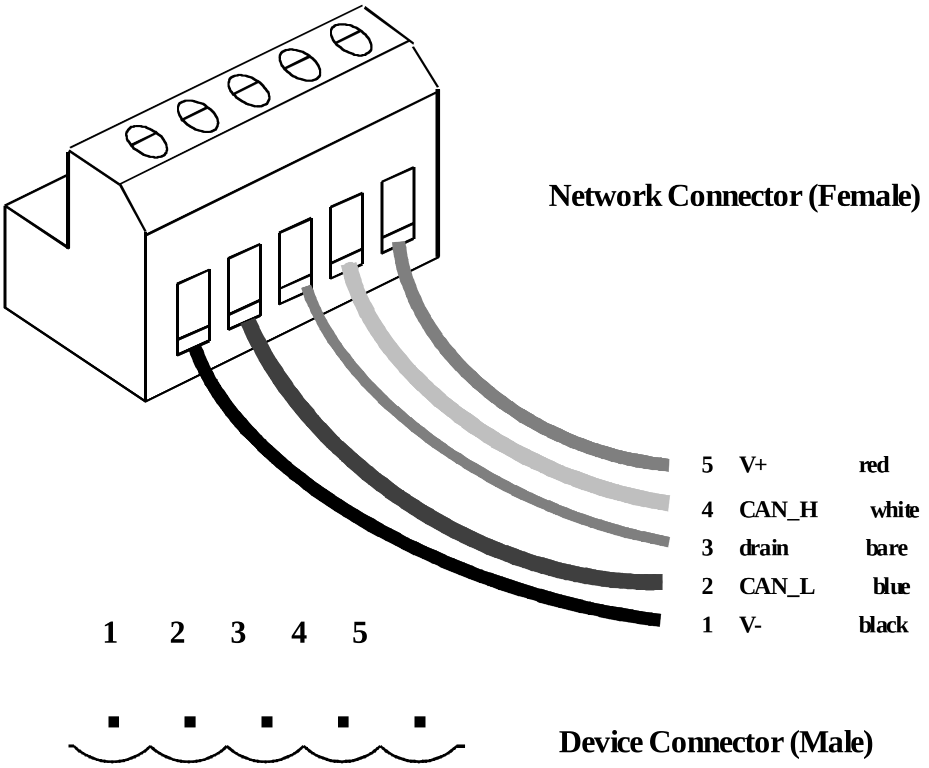
Screw Connectors:

The following figure illustrates wire insulation colours and pin outs for the screw connectors on DeviceNet. Shown are the following designations:

1. V_: (black)
2. CAN_L: (blue)
3. Drain: (bare)
4. CAN_H: (white)
5. V+: (red)

Important: DeviceNet requires that connectors on devices must have male contacts.

Pin Outs for Screw Connectors:



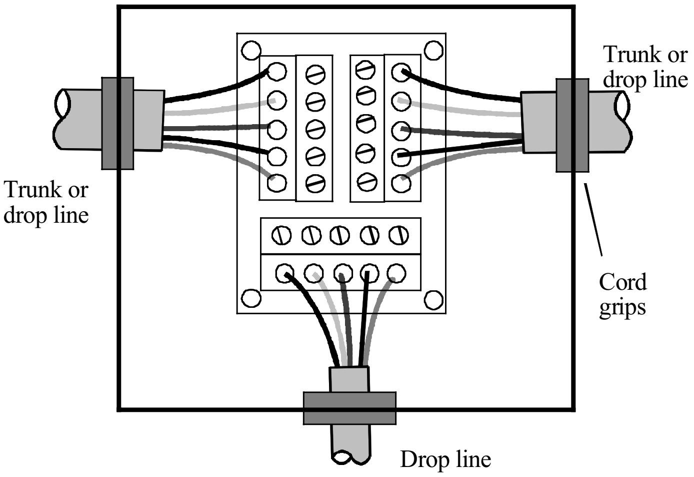
7.1.1.6.Device Taps

Device taps provide points of attachment onto the trunk line.

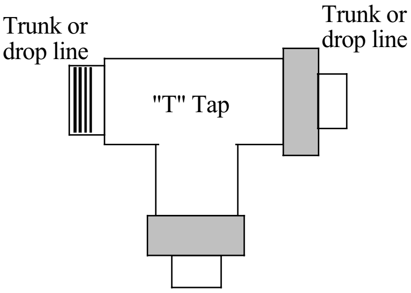
Devices can be connected to the network either directly to the tap or with a drop line. Taps also provide easy removal of a device without disrupting network operation.
For detailed specifications, refer to Appendix D of DeviceNet specifications.
Taps are defined for:

- sealed (with and without drop lines)
- open (with and without drop lines)

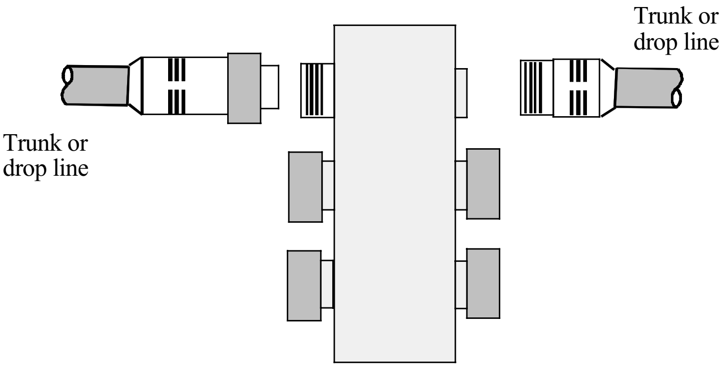
Sealed Taps:
Following Figure illustrates three examples of sealed device taps allowed on DeviceNet.



Junction box (with cord grips)



Sealed mini-style

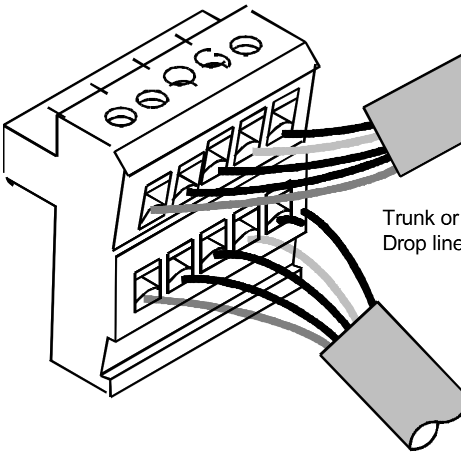


Sealed multi-port tap
with connectors for four drop lines

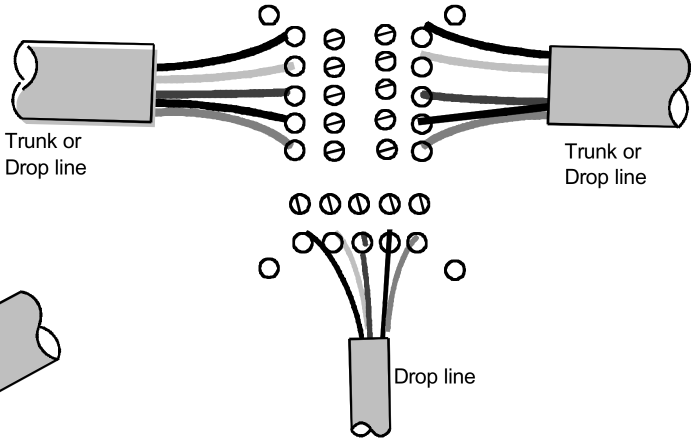
Open Tap:

Following Figure shows two types of open taps for DeviceNet.

The open, zero drop length tap provides two sets of wire terminations to allow daisy chaining of the trunk line.
This same open zero drop length tap can be designed to accommodate temporary terminal support.
The open tap with a drop consists of three sets of terminals to allow a drop line of up to 6 m/20 ft. to be connected to the trunk.
This style of tap will typically be used inside a control cabinet to connect a device to the trunk line.



For use as open tap with zero length drop line or for daisy-chain drop line



Open tap with drop line (up to 6   m/20 ft.)

7.1.1.7.Network Grounding

DeviceNet should be grounded at ONE location.
Grounding at more then one location may produce ground loops, while not grounding the network will increase sensitivity to ESD and outside noise sources.
The single grounding location should be at a power tap.
Sealed DeviceNet power taps are designed to accommodate grounding.
 Grounding of the network may be realised on the screw fixed on the heat sink.
The trunk drain/shield should be attached to the power supply ground or V_ with a copper conductor that is either solid, stranded, or braided.
Use a 1 copper braid or a #8 AWG wire that is less than 3 meters/10 feet in length.
This should then be attached to a good earth or building ground (such as an 8 foot stake driven into the ground, attached to building iron).
If the network is already grounded, do NOT connect the grounding terminal of the tap or ground of the supply to earth.
If more than one supply is on the network, then connect the drain wire/shield at ONE supply only.

8. PERFORMANCES

The system reaction time is described by the DeviceNet specifications.
At 500 kbauds following performances can be considered:

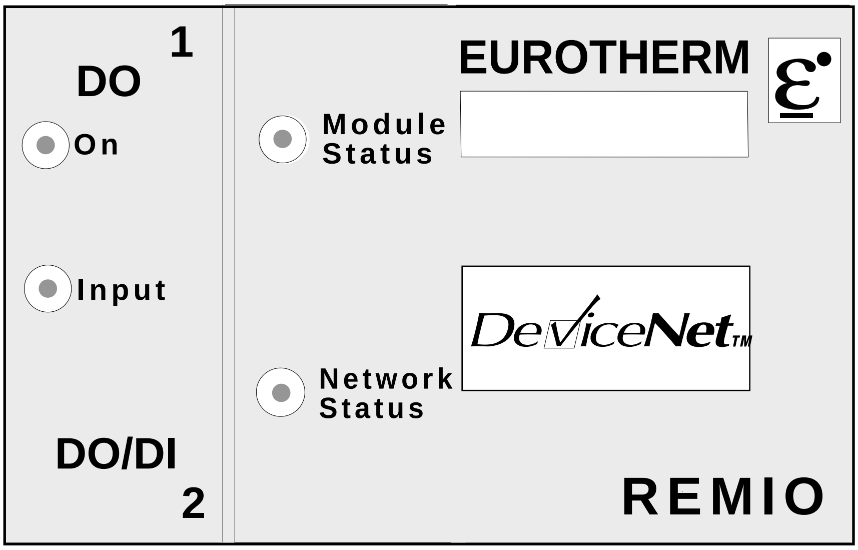
Read and Write of 48 TPO in less than 10ms @ 500 kbauds through the poll I/O Connection.

Read and Write of 48 DI-DO in less than 2ms @ 500 kbauds through the poll I/O Connection.

9. TROUBLE SHOOTING

Indicators assist maintenance personnel in quickly identifying a problem unit.
This is accomplished through the consistent placement and presentation of indicators on the REMIO front fascia.
DeviceNet does not require a product to have indicators. However, if a product does support any of the indicators described in DeviceNet specifications, they must adhere to the rules described volume 1 chapter 8.
The REMIO is equipped with 2 bi-color LED (Green / Red) which provide indications about the behaviour of the device.

- Module Status LED
- Network Status LED



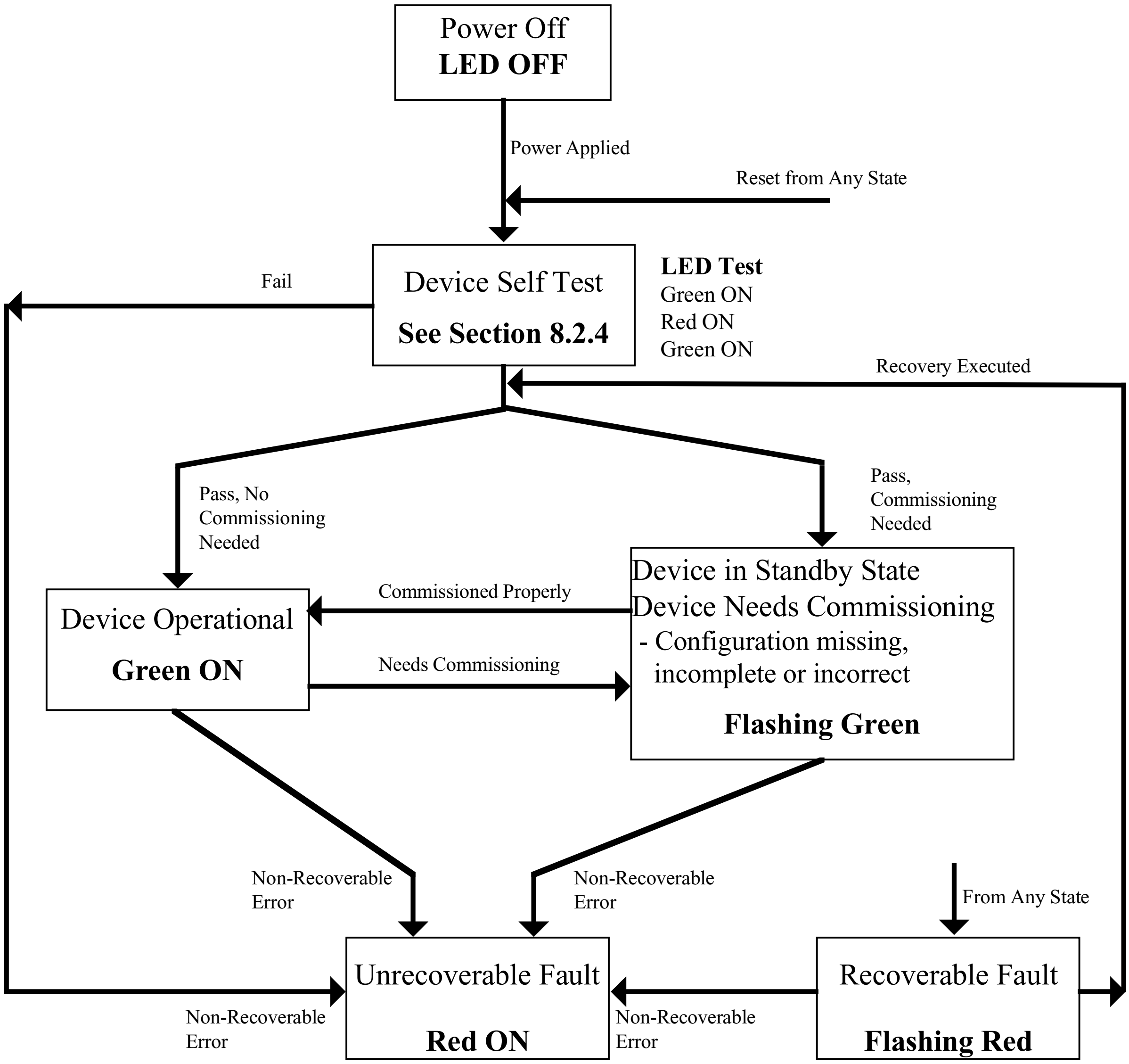
9.1. Module Status LED

This bi—color (green/red) LED provides device status. It indicates whether or not the device has power and is operating properly. The states shown below reflect the device states specified in the Identity Object specified in Volume II.

Module Status LED states:

For this state:	LED is:	To indicate:
No Power	Off	There is no power applied to the device
Device Operational	Green	The device is operating in a normal condition
Device in Standby (The Device Needs Commissioning)	Flashing Green	The device needs commissioning due to configuration missing, incomplete or incorrect. The Device may be in the Standby state. Reference the Identity Object in Volume II.
Minor Fault	Flashing Red	Recoverable Fault
Unrecoverable Fault	Red	The device has an unrecoverable fault; may need replacing
Device Self Testing	Flashing Red—Green (at power up)	The Device is in Self Test. Reference the Identity Object in Volume II for Device states (see∕9.3)

States of the Module Status LED:



9.2. Network Status LED

This bi—color (green/red) LED indicates the status of the communication link. Refer to chapter 2, section 8, Network Access State Transition Diagram, to compare the Network Status LED to the Network Access State machine.

Network Status LED states:

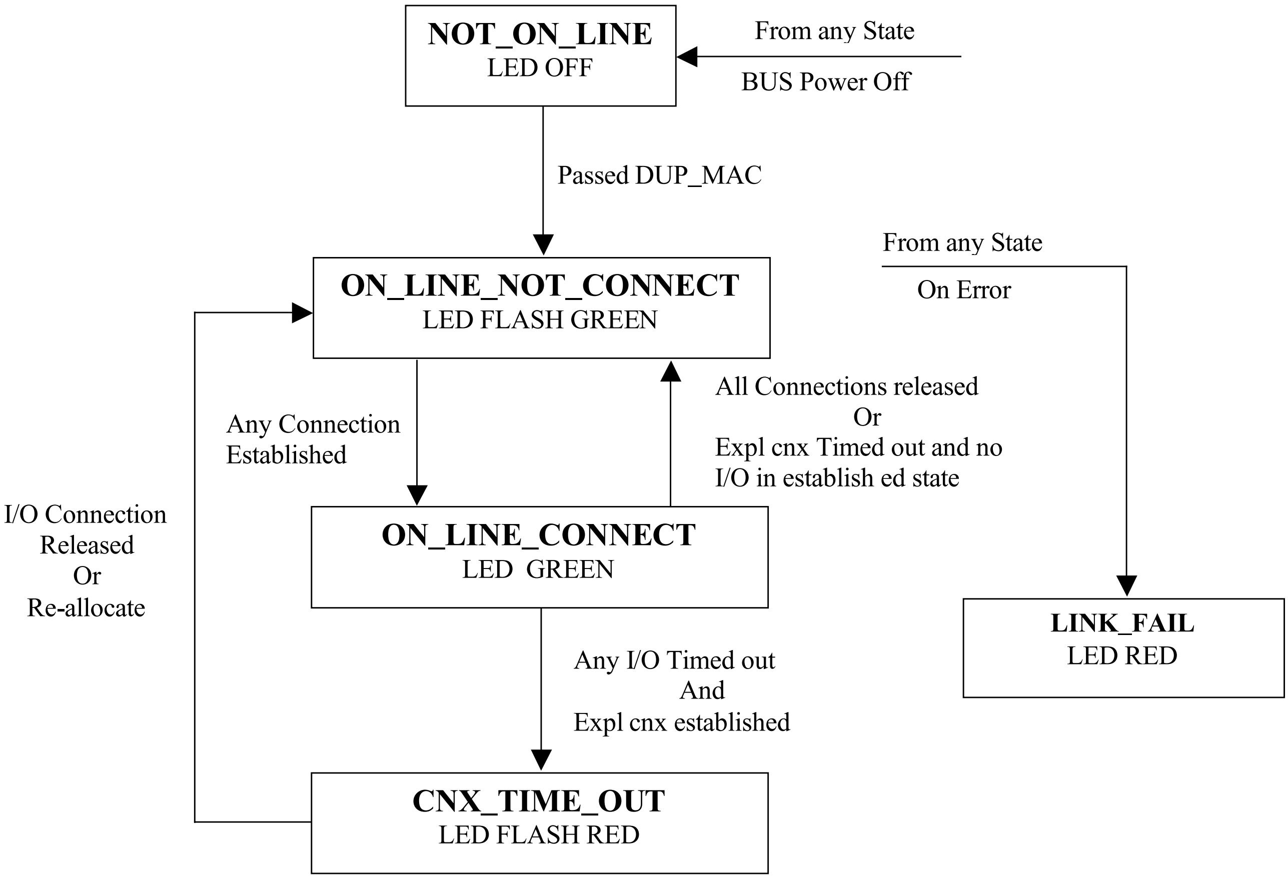
For this state:	LED is:	To indicate:
Not Powered/Not On—line	Off	Device is not on—line. • The device has not completed the Dup_MAC_ID test yet. _ • The device may not be powered, (Module Status LED is off too). • The DeviceNet link may not be powered, (Module Status LED is on)..
On—line, Not Connected	Flashing Green	Device is on—line but has no connections in the established state. The device has passed the Dup_MAC_ID test, is on—line, but has no established connections to other nodes. For a Group 2 Only device it means that this device is not allocated to a master.
Link OK On—line, Connected	Green	The device is on—line and has connections in the established state. For a Group 2 Only device it means that the device is allocated to a Master.
Connection Time—Out	Flashing Red	One or more I/O Connections are in the Timed—Out state
Critical Link Failure	Red	Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus—off).
Device Self Testing	Flashing Red—Green (at power up)	The Device is in Self Test. Reference the Identity Object in Volume II for Device states (see ⁄9.3)

Important: If a Red LED is ON or Flashing:

The Interface has detected a fault at the DeviceNET level itself.
It receives erroneous data, or receives nothing, or more simpler a bad Configuration has occurred.
The Interface is not able to reach the Data_Exchange State.
This diag. Appears also when the Watchdog Time-Out has occured.
In this case, following points must be verified:

- Connections
- Bus cable
- Bus length
- Impedance adaptation
- Address jumpers (Verify that any other Slave or Master has got the same address).
- BaudRate (must match with the Master Baud Rate)
- verify that Configurations are correctly assigned in the Master and that the watchdog Time-Out is not too short.
- Look at the EMC conformance of the installation.

States of the Network Status LED:


NOT_ON_LINE
LED OFF
From any State
BUS Power Off
Passed DUP_MAC
From any State
On Error
ON_LINE_NOT_CONNECT
LED FLASH GREEN
Any Connection Established
All Connections released Or Expl cnx Timed out and no I/O in establish ed state
I/O Connection Released Or Re-allocate
ON_LINE_CONNECT
LED GREEN
LINK_FAIL
LED RED
Any I/O Timed out And Expl cnx established
CNX_TIME_OUT
LED FLASH RED

9.3. Module and Network Status LEDs at Power—Up

A LED test is performed at power—up to allow a visual inspection to be performed. The following sequence must observed:

- Module Status LED off; Network Status LED off; Interface Status LED off.
- Module Status LED on Green for approximately 0.25 seconds.
- Module Status LED on Red for approximately 0.25 seconds.
- Module Status LED on Green.
- Network Status LED on Green for approximately 0.25 seconds.
- Network Status LED on Red for approximately 0.25 seconds.
- Network Status LED off.
- Network Status LED on Red.

9.4. Input / Output STATUS LEDs (all modules):

9.4.1. Digital Input/Output (DI/DO) modules:

Each module is equipped with 2 LEDs.

- GREEN
- ORANGE

The GREEN LED indicates that all is in order with the corresponding module (Power supply and internal connections).

The ORANGE LED is ON when the bi-directional Input/Output Port at the bottom of the card is configured as INPUT.

9.4.2. Time Proportioning Output (TPO) module:

Each module is equipped with 1 green LED which indicates that the module is correctly powered.

10. ELECTRONIC DATA SHEET (EDS):

The Data-Base which permits the configuration of the Master is established following the vol 2 chapter 4 of the DeviceNet specifications.

This EDS is available on 3.5 diskette.

Following files are available:

- REMBASIC.EDS
- REM16TPO.EDS
- REM32TPO.EDS
- REM48TPO.EDS

These ASCII files are reproduced bellow.

10.1. REMIO BASIC

```
$ DeviceNet Electronic Data Sheet (EDS)
$ File Name RemBasic.EDS

[File]
  DescText = "Remio Basic";
  CreateDate = 05-04-99;
  CreateTime = 17:00:00;
  Revision =1.1;

[Device]
  VendCode = 45;
  VendName = "Eurotherm Controls";
  ProdType = 0;
  ProdTypeStr = "Generic";
  ProdCode = 1;
  MajRev = 2;
  MinRev = 1;
  ProdName = "REMIO";

[IO_Info]
  Default = 0x0001;
  PollInfo = 0x0001,1,1;

  Input1 =
    6,0,0x0001,"Read variables",
    4,"20 04 24 01",
    "";

  Output1 =
    6,0,0x0001,"Write variables",
    4,"20 04 24 01",
    "";

[ParamClass]
  MaxInst = 6;
  Descriptor = 0x0000;         $CW
  CfgAssembly = 0;

[Params]
     Param1=
            0,
            6, "20 64 24 01 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 1",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
     Param2=
            0,
            6, "20 64 24 02 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 3",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
     Param3=
            0,
            6, "20 64 24 03 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 5",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
     Param4=
            0,
            6, "20 64 24 04 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 2",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
     Param5=
            0,
            6, "20 64 24 05 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 4",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
     Param6=
            0,
            6, "20 64 24 06 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "port 6",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used


[EnumPar]

[Groups]
```

10.2. REMIO 16*TPO

```
$ DeviceNet Electronic Data Sheet (EDS)
$ File Name Rem16TPO.EDS

[File]
  DescText = "Remio 16 TPO";
  CreateDate = 05-04-99;
  CreateTime = 17:00:00;
  Revision =1.1;

[Device]
  VendCode = 45;
  VendName = "Eurotherm Controls";
  ProdType = 0;
  ProdTypeStr = "Generic";
  ProdCode = 2;
  MajRev = 1;
  MinRev = 1;
  ProdName = "REM16";

[IO_Info]
  Default = 0x0001;
  PollInfo = 0x0001,1,1;

  Input1 =
    22,0,0x0001,"Read variables",
    4,"20 04 24 01",
    "TPO begin in 7";

  Output1 =
    22,0,0x0001,"Write variables",
    4,"20 04 24 01",
    "TPO begin in 7";

[ParamClass]
  MaxInst = 16;
  Descriptor = 0x0000;         $CW
  CfgAssembly = 0;

[Params]
Param1=
            0,
            6, "20 64 24 07 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO1",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param2=
            0,
            6, "20 64 24 08 30 01",
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO2",                       $Name
            "",                           $Unit
            "No Help Available",          $Help String
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
```

```
Param3=
          0,
          6, "20 64 24 09 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO3",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param4=
          0,
          6, "20 64 24 0a 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO4",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param5=
          0,
          6, "20 64 24 0b 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO5",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param6=
          0,
          6, "20 64 24 0c 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO6",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param7=
          0,
          6, "20 64 24 0d 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO7",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param8=
          0,
          6, "20 64 24 0e 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO8",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param9=
          0,
          6, "20 64 24 0f 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO9",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param10=
          0,
          6, "20 64 24 10 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO10",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param11=
          0,
          6, "20 64 24 11 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO11",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param12=
          0,
          6, "20 64 24 12 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO12",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param13=
          0,
          6, "20 64 24 13 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO13",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param14=
          0,
          6, "20 64 24 14 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO14",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param15=
          0,
          6, "20 64 24 15 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO15",
          "",                           $Unit
          "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0,0;          $Not used
  Param16=
            0,
            6, "20 64 24 16 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO16",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0,0;          $Not used

[EnumPar]

[Groups]
```

10.3. REMIO 32*TPO

```
$ DeviceNet Electronic Data Sheet (EDS)
$ File Name Rem32TPO.EDS

[File]
  DescText = "Remio 32 TPO";
  CreateDate = 05-04-99;
  CreateTime = 17:00:00;
  Revision =1.1;

[Device]
  VendCode = 45;
  VendName = "Eurotherm Controls";
  ProdType = 0;
  ProdTypeStr = "Generic";
  ProdCode = 3;
  MajRev = 2;
  MinRev = 1;
  ProdName = "REM32";

[IO_Info]
  Default = 0x0001;
  PollInfo = 0x0001,1,1;

  Input1 =
    38,0,0x0001,"Read variables",
    4,"20 04 24 01",
    "TPO begin in 7";

  Output1 =
    38,0,0x0001,"Write variables",
    4,"20 04 24 01",
    "TPO begin in 7";

[ParamClass]
  MaxInst = 32;
  Descriptor = 0x0000;         $CW
  CfgAssembly = 0;

[Params]
  Param1=
            0,
            6, "20 64 24 07 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO1",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param2=
            0,
            6, "20 64 24 08 30 01",
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO2",                       $Name
            "",                           $Unit
            "No Help Available",          $Help String
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
```

```
Param3=
          0,
          6, "20 64 24 09 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO3",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param4=
          0,
          6, "20 64 24 0a 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO4",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param5=
          0,
          6, "20 64 24 0b 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO5",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param6=
          0,
          6, "20 64 24 0c 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO6",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param7=
          0,
          6, "20 64 24 0d 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO7",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param8=
          0,
          6, "20 64 24 0e 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                        $USINT, 1 byte
          "TPO8",
          "",                         $Unit
          "No Help Available",
          0,255,0,                    $min, max, default value
          0,0,0,0,0,0,0,0,0;          $Not used
Param9=
          0,
          6, "20 64 24 0f 30 01",     $path
          0x0020,                     $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO9",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param10=
          0,
          6, "20 64 24 10 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO10",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param11=
          0,
          6, "20 64 24 11 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO11",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param12=
          0,
          6, "20 64 24 12 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO12",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param13=
          0,
          6, "20 64 24 13 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO13",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param14=
          0,
          6, "20 64 24 14 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO14",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param15=
          0,
          6, "20 64 24 15 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO15",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param16=
          0,
          6, "20 64 24 16 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO16",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param17=
          0,
          6, "20 64 24 17 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO17",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param18=
          0,
          6, "20 64 24 18 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO18",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param19=
          0,
          6, "20 64 24 19 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO19",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param20=
          0,
          6, "20 64 24 1a 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO20",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param21=
          0,
          6, "20 64 24 1b 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO21",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param22=
          0,
          6, "20 64 24 1c 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO22",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param23=
          0,
          6, "20 64 24 1d 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO23",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param24=
          0,
          6, "20 64 24 1e 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO24",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param25=
          0,
          6, "20 64 24 1f 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO25",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param26=
          0,
          6, "20 64 24 20 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO26",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param27=
          0,
          6, "20 64 24 21 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO27",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param28=
          0,
          6, "20 64 24 22 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO28",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param29=
            0,
            6, "20 64 24 23 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO29",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param30=
            0,
            6, "20 64 24 24 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO30",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param31=
            0,
            6, "20 64 24 25 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO31",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param32=
            0,
            6, "20 64 24 26 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO32",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used

[EnumPar]

[Groups]
```

10.4. REMIO 48*TPO

```
$ DeviceNet Electronic Data Sheet (EDS)
$ File Name Rem48TPO.EDS

[File]
  DescText = "Remio 48 TPO";
  CreateDate = 05-04-99;
  CreateTime = 17:00:00;
  Revision =1.1;

[Device]
  VendCode = 45;
  VendName = "Eurotherm Controls";
  ProdType = 0;
  ProdTypeStr = "Generic";
  ProdCode = 4;
  MajRev = 2;
  MinRev = 1;
  ProdName = "REM48";
  Catalog="";

[IO_Info]
  Default = 0x0001;
  PollInfo = 0x0001,1,1;

  Input1 =
    54,0,0x0001,"Read variables",
    4,"20 04 24 01",
    "TPO begin in 7";

  Output1 =
    54,0,0x0001,"Write variables",
    4,"20 04 24 01",
    "TPO begin in 7";

[ParamClass]
  MaxInst = 48;
  Descriptor = 0x0000;         $CW
  CfgAssembly = 0;

[Params]
  Param1=
            0,
            6, "20 64 24 07 30 01",       $path
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO1",
            "",                           $Unit
            "No Help Available",
            0,255,0,                      $min, max, default value
            0,0,0,0,0,0,0,0,0;            $Not used
  Param2=
            0,
            6, "20 64 24 08 30 01",
            0x0020,                       $monitor parameter
            8,1,                          $USINT, 1 byte
            "TPO2",                       $Name
            "",                           $Unit
            "No Help Available",          $Help String
            0,255,0,                      $min, max, default value
```

```
          0,0,0,0,0,0,0,0,0;             $Not used
Param3=
          0,
          6, "20 64 24 09 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO3",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param4=
          0,
          6, "20 64 24 0a 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO4",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param5=
          0,
          6, "20 64 24 0b 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO5",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param6=
          0,
          6, "20 64 24 0c 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO6",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param7=
          0,
          6, "20 64 24 0d 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO7",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param8=
          0,
          6, "20 64 24 0e 30 01",        $path
          0x0020,                        $monitor parameter
          8,1,                           $USINT, 1 byte
          "TPO8",
          "",                            $Unit
          "No Help Available",
          0,255,0,                       $min, max, default value
          0,0,0,0,0,0,0,0,0;             $Not used
Param9=
          0,
          6, "20 64 24 0f 30 01",        $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO9",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param10=
          0,
          6, "20 64 24 10 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO10",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param11=
          0,
          6, "20 64 24 11 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO11",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param12=
          0,
          6, "20 64 24 12 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO12",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param13=
          0,
          6, "20 64 24 13 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO13",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param14=
          0,
          6, "20 64 24 14 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO14",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param15=
          0,
          6, "20 64 24 15 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO15",
          "",                           $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param16=
          0,
          6, "20 64 24 16 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO16",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param17=
          0,
          6, "20 64 24 17 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO17",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param18=
          0,
          6, "20 64 24 18 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO18",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param19=
          0,
          6, "20 64 24 19 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO19",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param20=
          0,
          6, "20 64 24 1a 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO20",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param21=
          0,
          6, "20 64 24 1b 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO21",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param22=
          0,
          6, "20 64 24 1c 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO22",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param23=
          0,
          6, "20 64 24 1d 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO23",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param24=
          0,
          6, "20 64 24 1e 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO24",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param25=
          0,
          6, "20 64 24 1f 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO25",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param26=
          0,
          6, "20 64 24 20 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO26",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param27=
          0,
          6, "20 64 24 21 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO27",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param28=
          0,
          6, "20 64 24 22 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO28",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param29=
          0,
          6, "20 64 24 23 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO29",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param30=
          0,
          6, "20 64 24 24 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO30",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param31=
          0,
          6, "20 64 24 25 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO31",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param32=
          0,
          6, "20 64 24 26 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO32",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param33=
          0,
          6, "20 64 24 27 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO33",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;           $Not used
Param34=
          0,
          6, "20 64 24 28 30 01",      $path
          0x0020,                      $monitor parameter
          8,1,                         $USINT, 1 byte
          "TPO34",
          "",                          $Unit
          "No Help Available",
          0,255,0,                     $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param35=
          0,
          6, "20 64 24 29 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO35",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param36=
          0,
          6, "20 64 24 2a 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO36",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param37=
          0,
          6, "20 64 24 2b 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO37",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param38=
          0,
          6, "20 64 24 2c 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO38",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param39=
          0,
          6, "20 64 24 2d 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO39",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param40=
          0,
          6, "20 64 24 2e 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO40",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param41=
          0,
          6, "20 64 24 2f 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO41",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param42=
          0,
          6, "20 64 24 30 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO42",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param43=
          0,
          6, "20 64 24 31 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO43",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param44=
          0,
          6, "20 64 24 32 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO44",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param45=
          0,
          6, "20 64 24 33 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO45",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param46=
          0,
          6, "20 64 24 34 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO46",
          "",                           $Unit
          "No Help Available",
          0,255,0,                      $min, max, default value
          0,0,0,0,0,0,0,0,0;            $Not used
Param47=
          0,
          6, "20 64 24 35 30 01",       $path
          0x0020,                       $monitor parameter
          8,1,                          $USINT, 1 byte
          "TPO47",
          "",                           $Unit
```

```
            "No Help Available",
            0,255,0,                     $min, max, default value
            0,0,0,0,0,0,0,0,0;           $Not used
  Param48=
            0,
            6, "20 64 24 36 30 01",      $path
            0x0020,                      $monitor parameter
            8,1,                         $USINT, 1 byte
            "TPO48",
            "",                          $Unit
            "No Help Available",
            0,255,0,                     $min, max, default value
            0,0,0,0,0,0,0,0,0;           $Not used


[EnumPar]

[Groups]
```