MicroControl
Systemhaus für Automatisierung GmbH & Co. KG

µCAN.TRS

Manual for the Analogue Transmitter with CAN
Version 1.00

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Warranty Limitations

µCAN.TRS

Remarks on CE-conformance of µCAN-modules

µCAN-modules which have CE-conformance label, have passed test specifications of EU-criteria 89/336/EWG "Electromagnetic Emission and Immunitiy" and standardized European norms (EN).
Papers of declaration for EU-conformance, according to Art.10 of EN, are available at:

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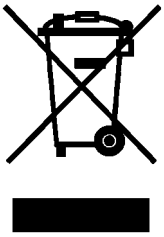
The products meet the requirements for the European WEEE

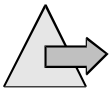


1. Safety Regulations

Symbol Explanation

Attention !

This symbol marks a paragraph which explains possible danger. This danger might cause a damage to the system / plant or damage to personnel.



Note

This symbol marks a paragraph which contains useful information for the work with the device or which gives just a hint.

1.1 General Safety Regulations

Attention !

Please read the following chapter in any case, because it contains important information about the secure handling of electrical devices.

This paragraph gives important information about the conditions of use. It was written for personnel which is qualified and trained on electrical devices.

Qualified and trained personnel are persons who fulfil at least one of the following conditions:

- You know the safety regulations for automated machines and you are familiar with the machine.
- You are the operator for the machine and you have been trained on operation modes. You are familiar with the operation of devices described in this manual.
- You are responsible for setting into operation or service and you are trained on repairing automated machines. In addition you are trained in setting electrical devices into operation, to connect the earthing conductor and to label these devices.

Terms of use

The devices described in this manual can only be used for the mentioned applications. Other devices used in conjunction have to meet the safety regulations and EMI requirements.

Safety Regulations

General Safety Regulations

Attention !

To ensure a trouble free and safe operation of the device please take care of proper transport, appropriate storage, proper assembly as well as careful operation and maintenance.

Hints for Installation

Please take care to observe the actual local safety regulations.

If devices are used in a fixed machine without a mains switch for all phases or fuses, this equipment has to be installed. The fixed machine must be connected to safety earth.

If devices are supplied by mains please take care that the selected input voltage fits to the local mains.

Safety Notice

If devices are supplied by 24V DC, this voltage has to be isolated from other voltages.

The cables for power supply, signal lines and sensor lines must be installed in a way that the device function is not influenced by EMI.

Devices or machines for industrial automation must be constructed in a manner that an unintentional operation is impossible.

Attention !

By means of hardware and software safety precautions have to be taken in order to avoid undefined operation of a automated machine in case of a cable fraction.

If automated machines can cause damage of material or personnel in case of a malfunction the system designer has to take care for safety precautions. Possible safety precautions might be a limit switch or locking.

2. Operation of µCAN.TRS

2.1 Overview

The µCAN.TRS enpowers the user to simply connect a wide variaty of analogue signals direct to the CAN bus.

Fig. 1: Analogue data transmitter µCAN.TRS

Typical signals to be acquired by the µCAN.TRS are temperature signals as well as analogue standard signals. Temperatuer sensors like Pt100 and Pt1000 resistors can direct be connected to the module. Thermocouple signals are linearized with an internal cold junction compensation. Also the use of a strain gauge is possible since the transmitter delivers the power output for th bridge. The standard signals +/-10V DC and 0(4)..20mA can also be connected.

The development in automation towards decentralized „intelligent“ systems makes the communication between these components quite important.

Modern automated systems require the possibility to integrate components from different manufacturers. The solution for this problem is a common bus system.

All these requirements are fulfilled by the µCAN.TRS module.

Operation of µCAN.TRS

Overview

The µCAN.TRS runs on the standard fieldbus CAN. Typical applications for the µCAN.TRS are industrial automation, transportation, food industry and environmental technology.

The µCAN.TRS runs with the protocol

according to the device profile DS-404. Other protocol stacks are available on request.

space saving and compact

The µCAN.TRS is designed for heavy duty applications. The aluminium cast ensures protection class IP65 up to IP67. The compact, space saving case gives the freedom to mount the module in many places.

inexpensive and service friendly

The quick and easy integration of the µCAN.TRS in your application reduces the development effort. Costs for material and personnel are reduced. The easy installation makes maintenance and replacement quite simple.

3. Project Planning

The chapter Project Planning contains information which are important for the system engineer when using the µCAN.TRS. These information include case dimensions and conditions of use.

3.1 Operation Area

The µCAN.TRS is a robust field module for acquisition of analgue signals via the CANbus. Every module can handle one analogue input signal. The module has a power supply range of 8V - 40V DC.

The PCB is incorporated in a robust case of protection class IP65. The µCAN.TRS is suited for mounting outside the switch cabinet. Long wires for actors or sensors are not longer necessary. Influence of EMI is reduced.

The µCAN.TRS needs four wires for connection to the power supply and CAN bus. Special CAN bus cables are available as accessories (refer to Ordering Information).

3.2 Maximum System Layout

For an operational system at least one network manager (or supervisor system) must be connected to the bus. This network manager might be a PLC or PC equipped with a CAN card. Every µCAN.TRS module is an active node.

A CANopen network manager can handle up to 127 network slaves (refer to Fig. 2, “Maximum System Layout”). Every module gets a unique address, which is set up via a DIP switch. The CANbus bus is connected through the µCAN modules. The last module in the network must be terminated by a termination connector. Connectors with CANbus termination are available at MicroControl.

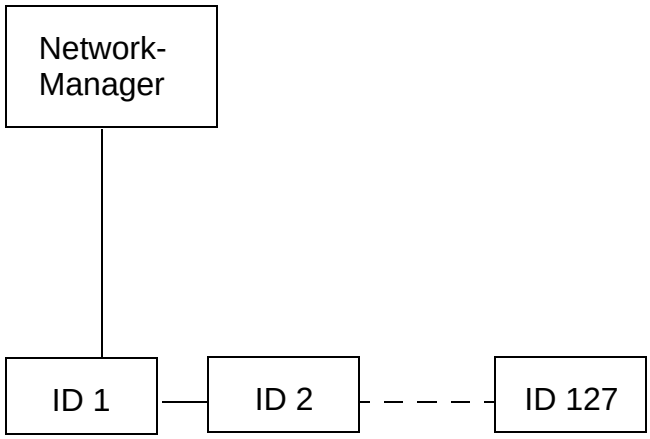


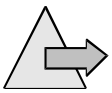
Fig. 2: Maximum System Layout

Maximum System Layout

The maximum cable length depends on the selected baudrate. The following table shows the maximum cable length recommended by the CAN in Automation (http://www.can-cia.org). These distances can be realized with the µCAN.TRS.

Baudrate in kBit/s	Cable length in m
1000	25
800	50
500	100
250	250
125	500
100	650
50	1000
20	2500
10	5000

Table 1: Dependence of baudrate from cable length



Note

It is recommended by the CAN in Automation **not to use** the baudrate 100 kBit/s in new CANopen systems.

3.3 Case Dimensions

The case dimensions of the module are given in the drawing below. The high protection class IP65 of the module allows an assembly at places with a harsh environment. It is possible to mount the module inside a switching cabinet as well as direct on a machine. Please check the technical data section for detailled information about maximum environment conditions.

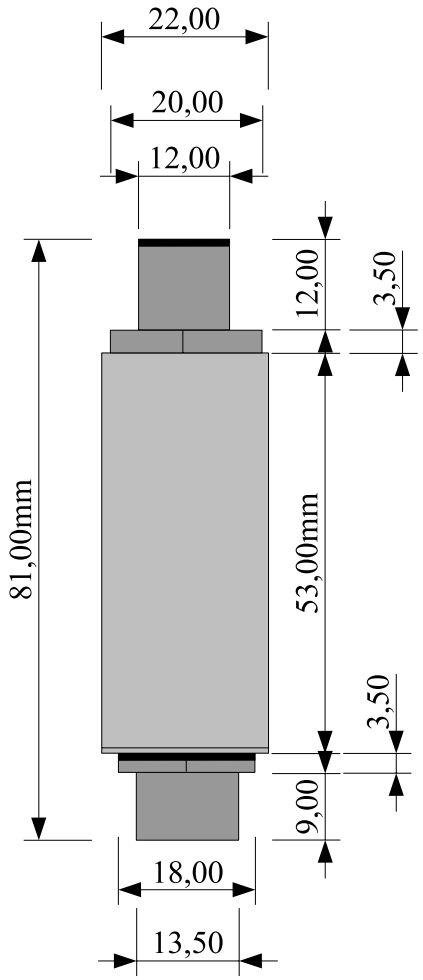


Fig. 3: Case dimensions

4. Installation

4.1 Potential Basics

The potential environment of a system that is realized with µCAN modules is characterized by following features:

- The CAN bus potential is isolated from the power supply.
- The electronic of the µCAN modules is isolated from the power supply.
- All µCAN modules have a separate power supply.
- All I/O signals are optically isolated from the CAN bus potential.

4.2 EMC Considerations

EMC (Electromagnetic Compatibility) is the ability of a device to work in a given electromagnetic environment without influencing this environment in a not admissible way.

All µCAN modules fit these requirements and are tested for electromagnetic compatibility in a EMC laboratory. However a EMC plan should be done for the system in order to exclude potential noise sources.

Noise signals can couple in different ways. Depending on that way (guided wave propagation or non-guided wave propagation) and the distance to the noise source the kinds of coupling are differentiated:

DC Coupling

If two electronic circuits use the same conductor we speak of a DC coupling. Noise sources are in that case: starting motors, frequency converters (switching devices in general) and different potentials of cases or of the common power supply.

Inductance Coupling

An inductance coupling is given between two current-carrying conductors. The current in a conductor will cause a magnetic field which induces a voltage in the second conductor (transformer principle). Typical noise sources are transformer, power cables and RF signal cables.

Capacitive Coupling

A capacitive coupling is given between two conductors which have a different potential (principle of a capacitor). Noise sources are in that case: parallel running conductors, static discharge and contactors.

RF Coupling

A RF coupling is given when electromagnetic fields hit a conductor. This conductor works like an antenna for the electromagnetic field and couples the noise into the system. Typical noise sources are spark plugs and electric motors. Also a radio set might be a noise source.

To reduce the impact of noise sources please take care to follow the basic EMC rules.

4.2.1 Grounding

General

All inactive metal plates must be grounded with low impedance. By this step all elements of the system will have the same potential.

Please take care that the ground potential never carries a dangerous voltage. The grounding must be connected to the safety earth.

Grounding of other modules

If µCAN modules are shipped in a plastic case they have to be grounded with a metal tape.

4.2.2 Shielding of cables

If noise is coupled to a cable shield it is grounded to safety earth via the metal cover. The cable shields have to be connected to the safety earth with low impedance.

Cable Types

For installation of the µCAN module you should only use cable with a shield that covers at least 80% of the core. Do not use cable with a shield made from metallized foil because it can be damaged very easy and has not a good shielding.

Cable Layout

In general the cable shield should be grounded on both ends. The cable shield should only be grounded on one end if an attenuation is necessary in the low frequency range. The cable shield can not be grounded on both ends for temperature sensors. The grounding on one end of the cable is necessary if

- there is no contact to the safety earth possible,
- analogue signals with only a few mV or mA are transmitted (temperature sensors).

4.2.3 CAN Cable

The CAN cable must meet the requirements of ISO11898. The cable must meet the following specifications:

Parameter	Value
Impedance	108 - 132 Ohm (nom. 120 Ohm)
Specific Resistance	70 mOhm/Meter
Specific Signal Delay	5 ns/Meter

Table 2: Specifications of CAN bus cable

The CAN bus cable is connected to the µCAN.TRS module via terminals inside the case. For the pinning of the terminal refer to “Power Supply / CAN Interface” on page 13 of this manual.

Attention !

Do not confuse the signal lines of the CAN bus, otherwise communication between the modules is impossible. The shield of the CAN bus cable may never lead inside the µCAN case. Never connect the shield to one of the terminals inside the case.

4.3 Power Supply / CAN Interface

The µCAN.TRS modules are designed for industrial applications. The supply voltage must be within the range from 8 V DC to 40 V DC. The input is protected against confusing the poles.

Please make sure not to confuse the poles when connecting the power supply. The positive supply is connected to the terminal **V+**. The negative supply is connected to the terminal **GND**.

Fig. 4: Connection of power supply

The CAN interface is connected via 2 pins of the M12 connector. Also make sure not to confuse CAN_H and CAN_L.

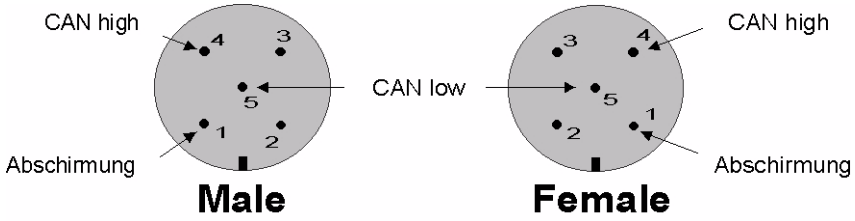


Fig. 5: CAN Interface connector

The M12 connector has the pinning according to the CiA specification for CANopen devices.

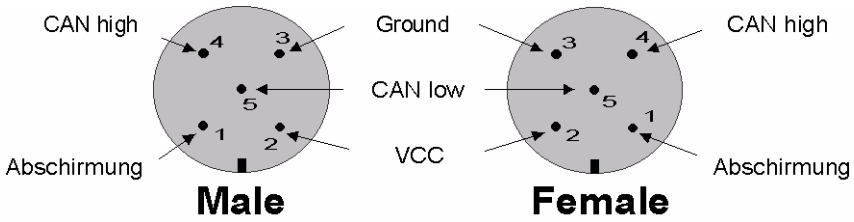


Fig. 6: Complete pinning of M12 Power+CAN connector

Attention !

A cable shield may not lead into the housing or may not be connected to a terminal inside the housing. Cable shields have to be connected to the terminals outside the housing.

4.4 Address- and Bitrate-Setting

The module address as well as the bitrate can only be changed by CAN bus interface. The protocol to change is the so called Layer-Setting services ("LSS"). Protocol is standarized and can be found in DS-305.

Attention !

Valid module addresses are within the range from 1..127, resp. 01h..7Fh. Each node within a CANopen network must have a unique module address (Node ID). Two nodes with the same Node ID are not allowed.

4.4.1 Baudrates

The supported baudrates of the µCAN.TRS module are given in the following table. The values are recommended by the CiA.

Baudrate (kBit / s)	1	2	3	4
1000	1	0	0	1
800	0	0	0	1
500	1	1	1	0
250	0	1	1	0
125	1	0	1	0
100	0	0	1	0
50	1	1	0	0
20	0	1	0	0
10	1	0	0	0

Table 3: Setup of baudrate

4.5 Termination

When using several modules on the bus make sure to terminate the CAN bus at the starting point and at the end with a resistor of 120Ohm. This ensures to run the CAN bus without physical disturbances like reflections.

To terminate the bus simply connect a resisitor of 120Ohm between the CAN-H and CAN-L bus line. When using the M12 connectors this can easiliy be done by using MicroControl´s M12-termination-connectors.

Note

Modules used as T-modules must not be terminated. Please make sure not to multiple terminate the bus. When measuring the resistance between CAN-H and CAN-L (in powered down network) you will get a total value of about 60Ohm.

5. Analogue Input

5.1 General Information

This chapter shows the different signal types and connection of signal lines to the µCAN.TRS. Ensure to use proper wiring and keep in mind EMI-rules. Other devices used in conjuction have to meet the safety regulations and EMI requirements. Only if these basic rules are fullfilled, the µCAN.TRS will deliver stable and high quality measuring signals.

Naming of input channel

The µCAN.TRS incorporates one analogue input channel. The inpur channel consists of 4 solder pads. In the following table and schematic the 4 pads are defined.

Name	Signal type
P1	Sensor supply, Pos. chain
G1	Sensor supply, Neg. chain
+	Signal +
-	Signal -

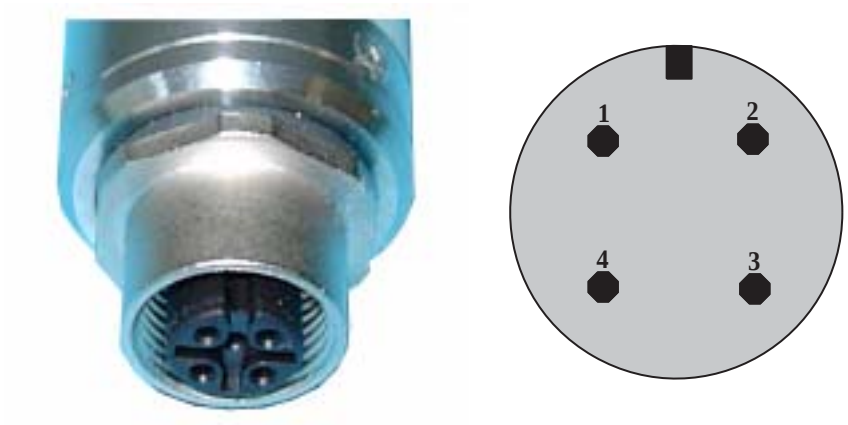


Fig. 7: Analogue input µCAN.TRS

Attention ! Please ensure to connect signal lines only if powered down the module. In any other case destruction of hardware may occur.

5.2 Temperature signals

5.2.1 Connection of temperature resisitors

As mentioned before the µCAN.TRS can diretcly handle thermo-couple signals as well as temperature resistors.

Connection of Pt100/Pt1000 or any other temperature resisitor is shown in the following schematic.

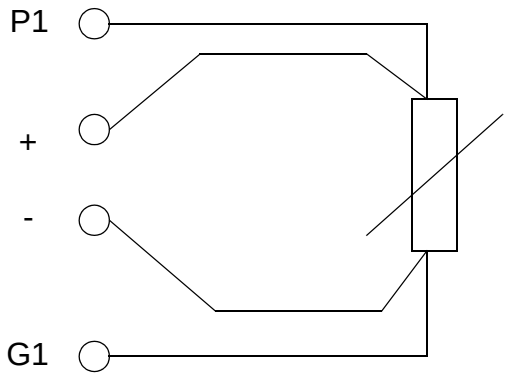


Fig. 8: Connecting temperature resisitors

5.2.2 Connection of thermocouples

Using thermocouple signals is as easy as using the temperature resisitors. Simply connect the signal chains according to the polarity to the "+" and "-" input pad.

In any case of polarity mismatch you will get negative measuring values at room temperature.

The following schematic shows the thermocouple connection of signal chains.

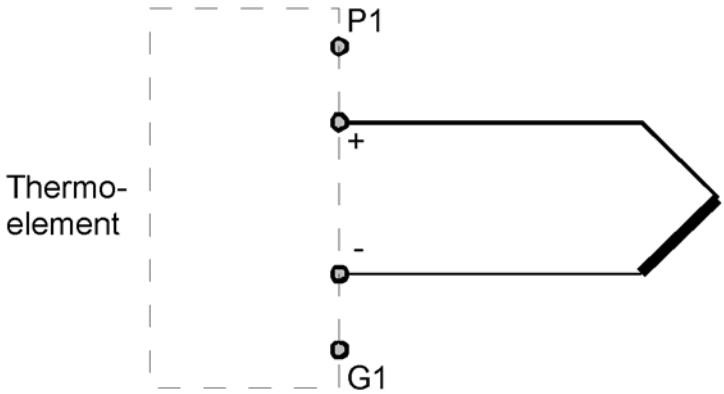


Fig. 9: Connecting thermocouples

Note

An automated cold junction compensation takes place on the pcb. The temperatures seen on the CAN bus are completely linearized and compensated.

5.3 Connection of strain gauge

When using strain gauges the bridge can be powered out of the µCAN.TRS. There is an constant voltage supply of 2.5V DC.

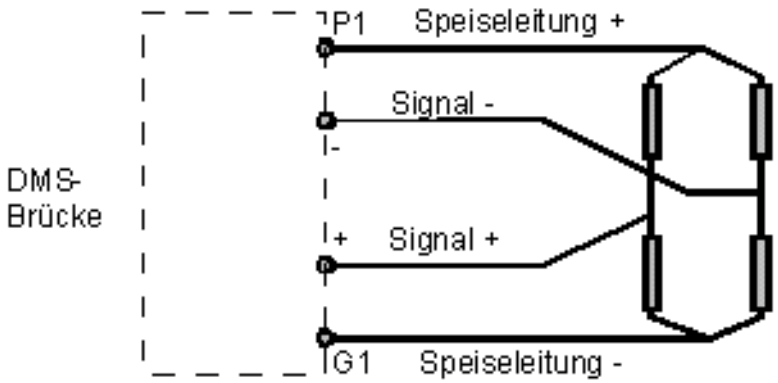


Fig. 10: Connecting strain gauges

5.4 Standard signals

Standard signals like +/-10V DC or 0(4)..20mA can be directly connected to the "+" and "-" solder pads. Please make sure not to confues the poles.

6. CANopen Protocol

This chapter provides detailed information on how to connect the modules of the µCAN-series to a CANopen-Manager. A CANopen-Manager can be a PLC, a PC with a CAN interface or any other CAN-Device with NMT functionality.

For more information about CANopen manager please refer to the supplied manuals of your CANopen master device.

This documentation provides the actual implemented functions and services of the µCAN.TRS.

6.1 Introduction

The identifiers of the µCAN.TRS are set up according to the **Pre-defined Connection Set**, which is described in the CANopen communication profile DS-301 in detail. The following table gives an overview of the supported services.

Object	COB-ID (dec.)	COB-ID (hex)
Network Management	0	0x000
SYNC	128	0x080
EMERGENCY	129 - 255	0x081 - 0x0FF
PDO 1 (Transmit)	385 - 511	0x181 - 0x1FF
PDO 1 (Receive)	513 - 639	0x201 - 0x27F
SDO (Transmit)	1409 - 1535	0x581 - 0x5FF
SDO (Receive)	1537 - 1663	0x601 - 0x67F
Heartbeat / Boot-Message	1793 - 1919	0x701 - 0x77F

Table 4: Identifier values according to the Pre-defined Connection Set

The direction (Transmit / Receive) has to be seen from the devices point of view.

6.2 Network Management

By means of the Network Management (**NMT**) messages the state of a CANopen node can be changed (Stopped / Pre-Operational / Operational).

Start Node

Start Node

ID	*DLC*	*B0*	*B1*
0	2	01h	Node

Node = module address, 0 = all modules

By transmitting the "Start Node" command the CAN-node will be set into Operational mode. This means that the node can handle PDO-communication.

Stop Node

Stop Node

ID	*DLC*	*B0*	*B1*
0	2	02h	Node

Node = module address, 0 = all modules

By transmitting the "Stop Node" command the CAN-node will be set into Stopped mode. This means that the node can not handle any services except NMT commands.

Pre-Operational

Enter Pre-Operational

ID	*DLC*	*B0*	*B1*
0	2	80h	Node

Node = module address, 0 = all modules

By transmitting the „Enter Pre-Operational“ command the CAN-node will be set into Pre-Operational mode. In this state the node can not handle PDO messages.

Network Management

Reset Node

Reset Node

ID	*DLC*	*B0*	*B1*
0	2	81h	Node

Node = module address, 0 = all modules

By transmitting the „Reset Node“ command the CAN-node will issue a reset operation. After reset the node will send a "Boot-up Message" (siehe “Heartbeat Protocol” auf Seite 34) and enter the Pre-operational state automatically.

6.3 SDO Communication

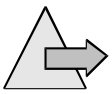
All parameters of the devices (organized in an object dictionary) are accessed via the SDO service (Service Data Object). A SDO message has the following contents:

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
	8	CMD	Index		Sub-Index	Data			

For calculation of the SDO message identifier please siehe “Introduction” auf Seite 21.

The Command Byte (**CMD**) has the following meaning:

Master wants to read from Slave	40h
Slave answers on the read-request	42h
Master wants to write to Slave	22h
Slave answers on the write-request	60h



Note

The byte order for the fields "**Index**" and "**Data**" is least significant byte first (Intel format).

Attention !

The minimum time delay between two succeeding SDO-commands must be greater than 20ms. Faster communication might lead to an unpredictible device status.

6.3.1 SDO Abort Protocol

The SDO abort protocol is used to signalize a fault when accessing an object. This SDO abort protocol has the following format:

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
	8	80h	Index		Sub-Index	Abort Code			

The identifier as well as the index and sub-index correspond to the SDO request.

The abort code may have the following values:

Abort code	Description
0504 0001h	Client / Server command specifier not valid / unknown
0601 0000h	Unsupported access to an object
0601 0001h	Attempt to read a "write-only" object
0601 0002h	Attempt to write a "read-only" object
0602 0000h	Object does not exist in the object dictionary
0609 0011h	Sub-index does not exist

Table 5: SDO abort codes

6.4 Object Dictionary

This chapter describes the implemented objects for the digital module µCAN.TRS. For further information please refer to the CANopen communication profile DS-301 and the device profile DS-401.

6.4.1 Communication Profile

The module µCAN.TRS supports the following objects from the communication profile DS-301:

Index	Name
1000h	Device Profile
1001h	Error Register
1003h	Predefined Error-Register
1005h	COB-ID SYNC-Message
1008h	Manufacturer Device Name
1009h	Manufacturer Hardware Version
100Ah	Manufacturer Software Version
100Ch	Guard Time
100Dh	Life Time Factor
1010h	Store Parameters
1011h	Restore Default Parameters
1014h	COB-ID Emergency-Message
1017h	Heartbeat Producer Time
1018h	Identity Object
1800h	1st Transmit PDO Parameters
1801h	2nd Transmit PDO Parameters
1A00h	1st Transmit PDO Mapping
1A01h	2nd Transmit PDO Mapping

Table 6: Supported objects of the communication profile

Device Profile

Index 1000h

The object at index 1000h describes the type of device and its functionality.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned32	ro	Device Profile	0003 0191h

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Example: read parameter, module ID = 2, index = 1000h

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
602h	8	40h	00h	10h	00h	00h	00h	00h	00h

As response the µCAN.TRS will send:

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
582h	8	42	00	01h	00	94h	01h	02h	00

Byte 5 + Byte 6 = 0194h = 404d (Device Profile Number)
Byte 7 + Byte 8 = 0002h = 2 (Additional Information)

Error Register

Index 1001h

The object at index 1001h is an error register for the device.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	ro	Error Register	00h

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Example: read parameter, module ID = 2, Index = 1001h

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
602h	8	40h	01h	10h	00	00	00	00	00

As response the module will return its error register value. The following error types are supported:

Generic Error

Bit 0 is set to ’1’. The generic error is set due to hardware faults.

Communication Error

Bit 4 is set to ’1’. The communication error is set due to faults on the CAN bus.

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Pre-defined Error Field

Index 1003

The object at index 1003h holds the errors that have occured on the device. The object stores a maximum of 10 error conditions.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	rw	Number of errors	00h
1 .. 10	Unsigned32	ro	Standard error field	0000 0000h

The object supports the sub-indices 0 to 10. An access to other sub-indices will lead to an error message. Writing to sub-index 0 will clear the error history.

Example: read parameter, module ID = 2, Index = 1003h

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
602h	8	40h	03h	10h	05h	00h	00h	00h	00h

As response the module will return the error value at position 5 in the history.

Manufacturer Device Name

Index 1008

The object at index 1008h contains the manufacturer device name.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Visible String	ro	Device name	µCAN.8.dio

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Manufacturer Hardware Version

Index 1009h

The object at index 1009h contains the manufacturer hardware version.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Visible String	ro	Hardware version	HW-1.1

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Manufaturer Software Version

Index 100Ah

The object at index 100Ah contains the manufacturer software version.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Visible String	ro	Software version	SW-1.0

The object is read-only. Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Store Parameters

Index 1010h

The object at index 1010h supports the saving of parameters in a non volatile memory.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	ro	Number of objects	3
1	Unsigned32	rw	Save all parameters	1
2	Unsigned32	rw	Save communication	1
3	Unsigned32	rw	Save application	1

In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate sub-index. The signature is "save".

Example: save all parameters, module ID = 2, index = 1010h

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
602h	8	22h	10h	10h	01h	73h	61h	76h	65h

As response the µCAN.TRS will send:

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
582h	8	60h	10h	10h	01h	00h	00h	00h	00h

Index 1011h

Restore Default Parameters

The object at index 1011h supports the restore operation of default parameters.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	ro	Number of objects	3
1	Unsigned32	rw	Restore all param.	1
2	Unsigned32	rw	Restore commun.	1
3	Unsigned32	rw	Restore application	1

In order to avoid the restoring of default parameters by mistake, restoring is only executed when a specific signature is written to the appropriate sub-index. The signature is "load".

Example: restore all parameters, module ID = 2, Index = 1011h

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
602h	8	22h	11h	10h	01h	6Ch	6Fh	61h	64h

As response the µCAN.TRS will send:

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
582h	8	60h	11h	10h	01h	00h	00h	00h	00h

Identity Object

Index 1018h

The object at index 1018h contains general information about the device.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	ro	Largest Sub-Index	4
1	Unsigned32	ro	Vendor ID	0000 000Eh
2	Unsigned32	ro	Product Code	0013 9F70h
3	Unsigned32	ro	Revision Number	0001 0000h
4	Unsigned32	ro	Serial Number	-

The object is read-only. Only sub-indices 0 to 4 are supported. An access to other sub-indices will lead to an error message.

Vendor ID

The Vendor ID contains a unique value allocated to each manufacturer. The numbers are managed by the CAN in Automation (http://www.can-cia.org).

Product Code

The Product Code identifies a specific device version.

Revision Number

The Revision Number consists of a major revision number (upper word) and a minor revision number (lower word). The major revision number identifies a specific CANopen behaviour. The minor revision number identifies different versions with the same CANopen behaviour.

Serial Number

The Serial Number identifies a specific device.

Guard Time

Index 100Ch

Über den Index 100Ch kann die Guard Time für das Node-Guarding Protokoll eingestellt werden. Die Multiplikation der Werte auf den Indicies 100Ch und 100Dh ergibt die "Life Time" eines Knotens.

Sub-Index	Datentyp	Zugriff	Bedeutung	Defaultwert
0	Unsigned16	rw	Guard Time	0

Das Objekt kann gelesen und geschrieben werden. Es wird nur Sub-Index 0 unterstützt. Ein Zugriff auf andere Sub-Indices wird mit einer Fehlermeldung quittiert.

Life Time Factor

Index 100Dh

Über den Index 100Dh kann der Life Time Factor für das Node-Guarding Protokoll eingestellt werden. Die Multiplikation der Werte auf den Indicies 100Ch und 100Dh ergibt die "Life Time" eines Knotens.

Sub-Index	Datentyp	Zugriff	Bedeutung	Defaultwert
0	Unsigned8	rw	Life Time Factor	0

Das Objekt kann gelesen und geschrieben werden. Es wird nur Sub-Index 0 unterstützt. Ein Zugriff auf andere Sub-Indices wird mit einer Fehlermeldung quittiert.

6.5 Heartbeat Protocol

The Heartbeat Protocol is used in order to survey other CANopen nodes in the network and retrieve their network state.

Heart Beat ID

The Identifier for the Heartbeat Protocol is set to 700h + module address. The Identifier can not be changed. The message repetition time (called "Heartbeat Producer Time") is configured with object 1017h.

The Heartbeat Protocol transmits one byte of data, which represents the network state.

Network State	Code (dec.)	Code (hex)
Bootup	0	00h
Stopped	4	04h
Operational	5	05h
Pre-Operational	127	7Fh

Table 7: Status Information for Heartbeat

After Power-on / Reset the module will send the "Bootup message" to signal that it finished the initialization sequence.

Example: Power-on of module with address 2

ID	*DLC*	*B0*
702h	1	00h

Producer Heartbeat Time

Index 1017h

The object at index 1017h defines the cycle time of the heartbeat. The producer heartbeat time is 0 if it is not used. The time is a multiple of 1ms.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned16	rw	Producer Time	0000h

Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Example: Producer Time 1000 ms, module address 1

ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
601h	8	22h	17h	10h	E8h	03h	00h	00h	00h

The answer you will receive from the module is:

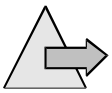
ID	*DLC*	*B0*	*B1*	*B2*	*B3*	*B4*	*B5*	*B6*	*B7*
581h	8	60h	17h	10h	00h	00h	00h	00h	00h

Note

The Heartbeat Producer Time is not saved inside the non-volatile memory autonomously. It is necessary to store this parameter via object 1010h (siehe “Store Parameters” auf Seite 30).

6.6 PDO Communication

The real-time data transfer is performed by means of "Process Data Objects" (PDO). The transfer of PDOs is performed with no protocol overhead.



Note

PDO communication is only possible in the network state "Operational".

6.6.1 Transmission Modes

Event Driven

Message transmission is triggered by the occurrence of an object specific event. For synchronous PDOs this is the expiration of the specified transmission period, synchronised by the reception of the SYNC object. For acyclically transmitted synchronous PDOs and asynchronous PDOs the triggering of a message transmission is a device-specific event specified in the device profile.

Timer Driven

Message transmission is either triggered by the occurrence of a device-specific event or if a specified time has elapsed without occurrence of an event.

6.6.2 Transmit PDO 1

Index 1800h

The object at index 1800h defines communication parameters for the Transmit-PDO.

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned8	ro	Largest Sub-Index	5
1	Unsigned32	rw	COB-ID for PDO	180h + Node
2	Unsigned8	rw	Transmission Type	FFh
5	Unsigned16	rw	Event Timer	0000h

Only sub-indices 0 to 2 and 5 are supported. An access to other sub-indices will lead to an error message.

COB-ID for PDO

Sub-Index 1 defined the identifier for the Transmit-PDO. The 32-bit value has the following structure.

Bit 31	Bit 30	Bit 29	Bit 28 - 0
PDO valid, 0 = valid 1 = not valid	RTR allowed, 0 = yes 1 = no RTR	Frame type, 0 = 11 Bit 1 = 29 Bit	Identifier,

Table 8: Definition of COB-ID for PDO

In order to enable the PDO the most significant bit (Bit 31) must be set to 0. In order to disable the PDO the most significant bit must be set to 1. In the default setting the PDO is active (Bit 31 = 0).

Transmission Type

The transmission type defines the transmission character of the PDO.

Transmission Type	Description
00h	acyclic synchronous,
01h - F0h (1 - 240 dez)	cyclic synchronous,
FFh (255 dez)	event driven, PDO is sent when Event Timer elapses

Table 9: Setup of Transmission Type

The Transmit-PDO has 2 bytes of process data. The contents is copied from object 7130h into the PDO.

Example: Temperature input at 200,8°C = 07 D8 hex, module address = 1

ID	DLC	B0	B1
181h	1	D8h	07h

Note

Transmission of the PDO is only possible in Operational Mode.

6.6.3 Transmit PDO 2

Index 1801h

Index 1801h has same settings like Index 1800h except for the fact that Transmit PDO 2 contains the so called field values.

The field value consist of 2 bytes data and contains the non-linearized values from the analog-to-digital converter. These data is normally not for use but in case of a linear ratio between input and output value (like 0..20mA) these values can be used for customer specific linearisation on the master module.

Example: Analogue input at 0V DC = 8000 hex, module address = 1

ID	DLC	B0	B1
281h	1	00h	80h

6.6.4 Synchronisation Message

Index 1005h

The object at index 1005h defines the identifier for the SYNC-message. On reception of a message with this identifier the transmission of PDOs is triggered (siehe “Transmit PDO 1” auf Seite 37)..

Sub-Index	Data Type	Acc.	Name	Default Value
0	Unsigned32	rw	COB-ID SYNC	80h

Only sub-index 0 is supported. An access to other sub-indices will lead to an error message.

Example: Set SYNC-ID to 10, module address 1

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
601h	8	22h	05h	10h	0Ah	00h	00h	00h	00h

As answer you will get the following message:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
581h	8	60h	05h	10h	00h	00h	00h	00h	00h

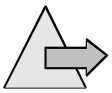
The default identifier is 80h in order to ensure a high priority of the SYNC-message.

Note

The SYNC-identifier is not saved inside the non-volatile memory autonomously. It is necessary to store this parameter via object 1010h (siehe “Store Parameters” auf Seite 30)

6.7 Emergency Message

Emergency objects are triggered by the occurrence of a device internal error situation and are transmitted from an emergency producer on the device.



Note

An emergency is different from a SDO Error Message. The last one only holds the access error to the object dictionary, whereas an emergency display a severe hardware/software failure.

The emergency identifier has the default value 128d + module-address. The emergency message has the following structure:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
	8	Error Code		00h	Manufacturer Specific Error Field				

The following emergency error codes are supported:

Error Code (hex)	Description
0000	Error Reset or No Error
1000	Generic Error
50xx	Device-Hardware
6000	Device-Software
80xx	Communication Error / Physical

Table 10: Emergency Error Codes

6.7.1 Device Specific Parameter

The µCAN.TRS contains the following device specific objects. These objects can be found in the DS-404 profile.

Object	Description	Access
6110	Sensor Type	ro
6112	Operating Mode	rw
6131	Process Value Physical Unit	ro
6132	Process Value Dec. Digits	ro
6150	Input Status	ro
6508	Alarm Type	rw
6509	Alarm Action	rw
650D	Alarm State	ro
7100	Field Value	ro
7130	Process Value	ro
7500	Alarm Input Value	ro
750A	Alarm Level	rw
750B	Alarm Hysteresis	rw

7. Technical Specification

7.1 µCAN.TRS

Technichal Specification

Supply Voltage	
Supply Voltage	8...40 V DC, polarity protected
Power consumption	typ. 350mW, max. 600mW
Connection	M12-connector
CAN-Interface	
Supported Bitrates	10kBit/s up to 1MBit/s (according to CiA recommandation)
max. number of nodes	127
Status on the bus	active Node
Protocol	CANopen, DS-404, customer specific protocols on request
CAN specification	2.0A and 2.0B
Connection	M12-connector
Environmental conditions	
Working temp.	-40°C ... +85°C
Storage temp.	-50°C ... +100°C
rel. humidity	15-95%
General	
Size (WxLxH)	81 x 22 mm
Weight	approx. 72 g
Sensor-Input	
Sensortypes	Thermocouple Typ J,K,L (different types on request) Pt100 / Pt1000

Signaltypes	+/- 10 V DC 0-20mA, 4-20mA Strain Gauge, 350 Ohm, 4-wire Pressure Transducers
Connection	M12 connector
Resolution	All signals are converted with 16Bit resolution at sample rates higher 200Hz resolution will decrease to 12Bit
EMC	
EMC	EN 50082-2
Electromagnetic fields	10 V/m, according to ENV 50204
Burst	5 kHz, 2 kV according to EN 6100-4-4
HF unsymmetrical	10 V, according EN 61000-4-6
	Emmision according to EN 50081-2, EN 55022, Class A