

U-Drive CanOpen Option

Setup and Operating Manual

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1 General Information

1.1 Safety

The CanOpen-Communication Card is an accessory unit for the U-Drive unit series. It is therefore subject to the same safety conditions. When commissioning a control unit, it is absolutely mandatory that the relevant Operating Instructions be used. These CanOpen Operating Instructions are no replacement for the former.

Instruction Manuals for the U-Drive unit:

[1] „U-Drive TA-U-Serie“ Commissioning and Setup Instructions from TAE

[2] PC Software „U-Drivemanager“ by TAE

Relevant Can/CanOpen Standards:

[CIA301]. CIA DS 301, CANopen application layer and communication profile

[CIA303/3] CiA DS 303, part 3: CANopen - Additional specification: Indicator specification

[CiA402]: CiA 402: CANopen drive and motion control device profile

In principle, electronic devices are not failure-proof. The user is responsible for ensuring that the drive unit is maintained in a safe condition in the event of a device failure.

1.2 Specifications and regulations

Please observe the general installation information for electrical installations:

VDE0100 Specification for the installation of power systems with a nominal voltage of up to 1000V.

VDE0113 Specification for electrical equipment on machining and processing systems.

VDE0160 Equipping power systems with electronic devices.

If the control unit is used in special areas of application, then the required Accident Prevention Guidelines and standards must be observed.

1.3 General

Following production, all units undergo a full functional test as well as a 200 hour endurance test. These units are subjected to another complete functional test prior to delivery.

These measures are used to ensure that only perfect units are shipped out to customers.

Under normal circumstances no malfunctions are expected, provided the drive dimensioning is correct and the information contained in the Operating Instructions are followed. However, if a defect should be discovered, please contact one of our representatives or get in touch with us directly

1.4 Target audience

These Operating Instructions are directed at the user with the appropriate qualification to ensure this unit is handled properly and professionally.

1.5 Liability

The user should not attempt to rectify any faults within the unit. Non-authorised interventions will lead to all guarantee claims against TAE becoming null and void.

User intervention, e.g. for repair purposes, lead to an exclusion of all liability on behalf of TAE. If you have any doubts concerning the cause of the fault or its rectification, please notify TAE, to avoid further damages.

2 Commissioning and Configuration

2.1 CanOpen Basic Configuration

Apart from Baudrate and Device-Id all adjustments can be done using the PC Operator Software „U-Drive Manager“, the „PG4000“ programming device or on a fieldbus directly using SDO Transfers.

The U-Drive CanOpen Module supports dynamic mapping of PDOs and offers 8 Receive and 8 Transmit-PDOs, which are internally mapped in single PDO channels.

All Fieldbus Parameters can be found in Group [15] „Bus/Com“, in area [600ff].

2.2 Baudrate and Device-ID

For Commissioning the U-Drive for use in a CanOpen Fieldbus network, the baudrate of the CAN network and Device-ID need to be set first.

ID	Name	Range	Default	Unit	Access
600	Device ID	0 ... 126	---		RW
650	CO-Baudrate	10 ... 1000	250	kBaud	RW

Here the Parameter Can-Baudrate [650] is an enumeration with the following meanings:

Value:	CAN Baudrate
0	1000 KBaud
1	800 KBaud
2	500 KBaud
3	250 KBaud
4	125 KBaud
5	100 KBaud
6	50 KBaud
7	20 KBaud
8	10 KBaud

Tabelle 1: [650] Baudrates

When these two parameters are set according to the fieldbus network, the device is ready to participate in it as a slave-device.

Please note, that for CanOpen the device-id has to be greater than zero!

After a change of the device-id the CanOpen-Node has to be set into the state *RESET COMMUNICATION* for the change to take effect!

2.2.1 Heartbeat

The desired Heartbeat Time can be set in Parameter [643]. The active Heartbeat-Time will always be shown in

Parameter [644].

Setting Heartbeat-Time to zero will disable the Heartbeat function.

ID	Name	Range	Default	Unit	Access
643	CO Heartbeat Set	0 ... 30000	1000	ms	RW
644	CO Heartbeat Act	0 ... 30000	1000	ms	R

Acknowledge of Parameter [643] has to be triggered in the CO-Controlword ([641], Bit #4).

2.2.2 Manufacturer Specific Parameters

2.2.2.1 Addressing

The Object Dictionary, as seen from the PC in the operating software, will be mapped to the manufacturer specific area of the CanOpen Object Dictionary. The procedure of mapping TAE Parameter Ids to CanOpen Object Ids (CobIds) is described in the following section.

The reserved area for manufact. spec. Parameters starts with CobId 0x2000. Because in the domain of fieldbusses and PLCs hexadecimal notation is commonly used for Object-IDs, we have implemented the mapping from the TAE Ids – which are decimal – to CobIds in a way, that will make them easily recognizable from a Fieldbus centered view.

Therefore the decimal Ids of parameters are simply read and interpreted as if given in hexadecimal notation and offsetted by adding 0x2000 into the Manufacturer Area above 0x2000.

From a parameter-id „XYZd“ (d for decimal) will become a CobId „2XYZh“ (h for hexadecimal)

Parameter-IDs greater than 1000d likewise map to CobIDs above 3000h. The Offset of 2000h is simply added to the reinterpreted decimal parameter id.

Examples:

Parameter ID	Parameter Name	CobID
[520]	Actual Speed	2520h
[551]	DrvCtrl Fbus (Controlword for Fieldbusses)	2551h
[1040]	Sample Bank Selection	3040h

2.2.2.2 Datatypes and Scaling for PDO Transfers

For PDO Transfers a value range of 16 bit with sign-bit is used.

SDO Transfers are not limited to this value-range

All Parametes will be scaled as real (engineering) values and transmitted. The Scaling is done into an integer based fixed-comma format with adjustable decimal for speeds and torque/current.

The number of decimals can be set in the following parameters:

ID	Name	Range	Default	Unit	Access
618	FBus Speed Decc	-1 ... 3	0		RW
619	FBus Current/Torque Dec	-1 ... 3	1		RW

A value of „-1“ in one of these parameters will result in the parameter to be reset to a decimal that is best fit for the resolution of the given controller.

**Please keep in mind, that the resulting values for PDO Transfers should never exceed the 16bit +sign value range of +32767 to -32768!
 Values exceeding this range will be binary cut of on word boundary an become invalid!
 Is is up to the user to ensure this constraint is met within his application.**

2.2.2.3 Access and PDO-Mapping

In order not to constraint the possible applications without need, in general all of the TAE parameters on the drive-unit can be mapped into PDOs, even where this may not seem reasonable on first sight. This gives users the opportunity to set up a system without any need for SDO transfers.

For this reason access rights are limited to RW (Read-Write) und RO (Read-Only). The access right „CONST“ as given in the CanOpen Standard shall not be used, as this can hinder the use such parameters in PDOs.

2.3 Mapping of Parameters for PDO Transfers

The mapping of parameters into Receive- and Transmit-PDOs can be adjusted with the operating software, the „PG4000“ or by a bus-master in the bootup phase utilizing standardized CanOpen mapping procedures.

The parameters containing the Ids of the mapped parameters are the following:

[620 ...627]	TxPdo 1-8	Transmit-Pdos (Actual-Values)
[630 ...637]	RxPdo 1-8	Receive-Pdos (Set-Values)

In these parameters the decimal TAE Parameter IDS must be given, that are to be mapped. Other Objects can not be mapped in this way.

Changes in the mapping, that are done from a bus-master into the communication-segment of the standard CanOpen Communication Profile will be reflected into these parameters, if the map to TAE parameters.

The given mappings are activated on switching on the device, if they were stored in the internal memory.

2.4 Command and Status Words

In the following section various Command- and Status parameters are described, by whom the CanOpen network can be tested and controlled.

2.4.1 [641] CO-Controlword

ID	Name	Range	Default	Unit	Access
641	CO-Control	0000h ... F3FFh	0000h	[bits]	RW

In the Controlword a number of functions of the CanOpen Module can ba activated.

CO-Control		
Bit	Bezeichnung	Funktion/Bedeutung
0	Reset	Set Baudrate, reload PDO mapping
1	SetBaudrate	Acknowledge Baudrate in [640]
2	–	--
3	--	--
4	SetHeartbeat	Acknowledge Heartbeat-Time in [643]
5	Reload PDO Mapping	Mapping Einträge are [620 ... 627, 630 ... 637] werden acknowledged
6	SetNodeState	Manually set the NodeState (FOR TESTING PURPOSES ONLY !)
7	CustomCobWrite	Write value from[649] to the object dictionary (see further down.)
8	–	–
9	–	–
10	–	–
11	–	–
12	TxPDO 1	PDO 1 transmit
13	TxPDO 2	PDO 2 transmit
14	TxPDO 3	PDO 3 transmit
15	TxPDO 4	PDO 4 sendentransmit

Tabelle 2: [641] CO-Control Functions

2.4.2 [642] CO-Driver Statusword

ID	Name	Range	Default	Unit	Access
642	CO-Driver State	0000h ... 007Fh	0000h	[bits]	R

Bit	Bezeichnung	Funktion/Bedeutung
0	CANFLAG_INIT	CanModul initializing
1	CANFLAG_ACTIVE	CanModul is active
2	CANFLAG_BUSOFF	CanModul in Bus-Off
3	CANFLAG_PASSIVE	CanModul Error-Passive State
4	CANFLAG_OVERFLOW	CanModul Error: Datagram Overflow
5	CANFLAG_TXBUFFER_OVERFLOW	CanModul: Send-Buffer Overflow
6	CANFLAG_RXBUFFER_OVERFLOW	CanModul: Receive-Buffer Overflow

Tabelle 3: [642] States of the Can-Drive

2.5 [645,646] CanOpen NodeState

ID	Name	range	default	Unit	Access
645	CO NodeState Set	[00] ... [129]	[00]		RW
646	CO NodeState Act	[00] ... [129]	[00]		RO

The NodeState can be manually set in parameter [645] (activated in [641], bit #6). This function is strictly limited for Testing-Purposes and should not be used in a running system!

The parameter [646] signals the actual node-state of the device

Wert	Bezeichner	Bedeutung
0	OFF	Can is not active
1	CO_INITIALISING	Can initializing
4	CO_STOPPED	Can stopped
5	CO_OPERATIONAL	Operational Mode (SDO + PDO)
127	CO_PRE_OP	Pre-Operational Mode (SDO only)
128	CO_RESET_APP	Reset Application is active
129	CO_RESET_COM	Reset Communication is active
0x19	PL_INITIALISING	(EPL)
0x29	PL_RST_APP	(EPL)
0x39	PL_RST_COM	(EPL)
0x79	PL_RST_CFG	(EPL)
0x1c	PL_NOT_ACTIVE	(EPL)
0x1d	PL_PRE_OP_1	(EPL)
0x5d	PL_PRE_OP_2	(EPL)
0x6d	PL_RDY_OP	(EPL)
0xfd	PL_OPERATIONAL	(EPL)
0x4d	PL_STOPPED	(EPL)
0x01e	PL_BASIC_ETH	(EPL)
0xff	PL_UNKNOWN	(EPL)

Tabelle 4: Valid NodeStates

Some of these values refer to the EPL (Ethernet Powerlink) Option Module of the U-Drive and are not valid for a CAN-based CanOpen Network. These are marked in the table above as (EPL).

2.6 Access on the CanOpen Object-Dictionary

The following parameters allow the direct access on the CanOpen Objects for testing purposes.

ID	Name	range	default	access	
647	CO ObjIndex	0 ... 32767	0	RW	CanOpen Index
648	CO SubIdx	0 ... 127	0	RW	CanOpen SubIndex
649	CO Value Set	0 ... 4294967295	0	RW	Set-Value (Write must be acknowledged in [641]!)
650	CO Value Read	0 ... 4294967295	0	R	Actual Value of the object
651	CO ValueSize	0 ... 4294967295	0	R	Object size (bits)
652	CO ValAddress	0 ... 4294967295	0	R	Object internal address
653	CO Val#Test	0 ... 4294967295	0	R	-
654	TAE_CoBuffer_Id	0 ... 1200	0	RW	TAE Parameter ID
655	TAE_CoBufferValue	0 ... 4294967295	0	R	Value of the TAE Parameter in the Can-Transfer buffer

2.7 Extensions of the CanOpen standard

Please regard, that the extensions described here are fully compatible with the CanOpen standard and explicitly encouraged therein.

2.7.1 1029h „Error Behaviour“

The CanOpen Object with Id 1029h „Error Behaviour“ was extended by a sub-index, that defines how the device should react, when communication is disturbed while not yet in the bus-off state. This is necessary to be able to react on such errors as early as possible.

An example may be a breakdown of communication for a loss of physical connection of the transmission lines.

The node-state „bus-off“ will normally not be triggered by such errors of communication. Only errors on the physical transmission-level, bit-errors in the CAN data-stream caused by electrical interference or shortcuts of the signal lines can lead to a bus-off state!

The Object 1029h has an additional sub-index 1029h/002, that defines the behaviour in such cases, which lead to the CAN node-state „Error Passive“. The subindexed is modeled after the preceding sub-index 001 of the same object.

Value		Name	
0		pre - operational	
1		no state change	
2	*	stopped	Default!

Tabelle 5: Object 1029h, Subindex 002

Detection of a disturbed bus-traffic depends on the frequency of transmissions: the more datagrams are not acknowledged by the network, the faster the device will reach the „Error-Passive“ state. If this has to work in Pre-Operational mode, where traffic on the bus is typically low compared to the PDO loaded Operational mode, a periodic traffic can be assured by activating the heartbeat function.

Please keep in mind:
It is practically impossible to ensure the detection of a disturbed communication under all circumstances in a pre-defined time-frame!

2.8 EDS/XDD File

The EDS/XDD Files, that are used to configure and integrate a CanOpen-Device into a CanOpen network using thire-party configuration software can be obtained from the TAE-homepage (<http://tae-antriebstechnik.de>).

3 Connection and Displays

3.1 Status-Display

The network-status will be signaled by a bicolour LED on the connection plate of the drive-unit. The meaning of the signals follows CanOpen standards (s. [CIA303/3]) and is given in the following table.

LED	CanOpen Status
Green blinking, fast	Pre-Operational
Green blinking, slow	Stopped
Green light, continuous	Operational
Alternating green/red blinking	Bus-Warning/Bus-Off

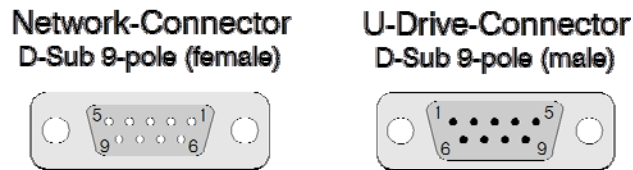
Blinking-Sequence:

- Blinking Fast (CIA: „Blinking“):
ON: 200 ms, OFF: 200ms
- Blinking Slow (CIA: „Single Flash“):
ON: 200ms OFF: 1000ms

If the Status-Display does not show any sign, please check, if the Can-Module has been properly detected (see Parameter [610]) and a valid device-id ist activated!

3.2 Connection

The U-Drive connects to a CanOpen network via the standardised male D-Sub 9 connector.



The Device-Connector is located on the lower half of the Display-Board of the U-Drive.. The female Network-Connector makes eonnection to the network.

Pin-assignment is as follows:

Pin	Assignment	Pin	Assignment
1	–	6	CAN GND
2	CAN LOW	7	CAN High
3	CAN GND	8	–
4	–	9	–
5	–	Shield	Ground

3.3 Termination

If the device is on the end of a bus-strang, transmission lines have to be terminated by a termination-resistor to avoid signal-reflections on the bus and maintain data-safety on the network.

The Switch S1 then needs to be set to ON:

