4 ANALOG SIGNAL OUTPUT
with CANopen®

USER MANUAL

P/N: AX030501

VERSION HISTORY

Version	Date	Author	Modifications
REV A	Sept 28, 2010	Antti Keränen	Initial release, based on the UMAX030500 manual
-	Oct 7, 2010	Amanda Wilkins	Marketing Review
REV B	Oct 11, 2010	Antti Keränen	Description of object 1000h updated
REV C	Dec 10. 2010	Antti Keränen	RPDO mappings changed, binary I/O functions defaults changed to 1.0. Removed object 30D0h. EMCY codes updated. New figures and tables. Object 3240h introducts
REV D	Dec 15, 2010	Antti Keränen	Object 3400h default value fixed. Object 6302h data type changed to UNSIGNED8
V2.0.0	Feb 17, 2011	Anna Murray	Formatting updated to match Axiomatic template. Moved version history. Added new object 5555h
-	Sept. 29, 2011	Amanda Wilkins	Added response time to Tech. Specs
-	July 3, 2015	Amanda Wilkins	Added vibration compliance to Tech. Specs
V2.1.0	Feb 1, 2017	Antti Keränen	Contents updated to reflect the functionality of the firmware v2.00.
V2.1.1	May 15, 2020	Antti Keränen	Added a note about VPS measurement being disabled due to hardware limitation. Title page footer updated.
V2.1.2	July 31, 2023	Kiril Mojsov	Performed Legacy Updates

ACRONYMS

CAN	Controller Area Network
CANopen®	CAN-based higher layer protocol supported by CAN in Automation (CiA)
ECU	Electronic control unit
EMI	Electromagnetic Interference
LSB	Least Significant Byte
PC	Personal Computer
RS-232	PC serial port interface
USB	Universal Serial Bus
UTP	Un-shielded twisted pair

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1   INTRODUCTION

The following manual describes the controller software architecture, network functionality, CANopen® object dictionary and firmware programming of the 4 Analog Signal Output CAN Controller (4AOUT). The manual is intended to provide users with all necessary information for programming of custom solutions on the base of this controller.

The manual is valid for a specific major firmware version. Please, ensure that the firmware version installed on your controller is covered by this manual (see Object 1018h: Identity Object).

Hardware information presented in this manual is limited and intended only to complement the material or for troubleshooting purposes. For detailed hardware information, please refer to the technical datasheet and other relevant documents.

The controller is intended to operate with CANopen® bus. It is assumed, that the user is familiar with CANopen® standard; the terminology from this standard is widely used in the manual.

The programming is performed through CAN interface and does not require disconnection of the controller from the user system CAN bus after the controller is installed in the system.

2   CONTROLLER DESCRIPTION

The controller is designed to monitor application signals transmitted on the CAN bus by various ECUs using four universal analog signal outputs. Each of the outputs can be individually programmed to output voltage or current in the user-defined output range. The ECU application signals can be pre-processed before being output in case an advanced monitoring logic is required.

The 4AOUT belongs to a family of Axiomatic user-customizable smart controllers. The programmable internal architecture provides users with an ultimate flexibility, allowing them to build their own custom controller with a required functionality from a set of predefined internal functional blocks using any commercially available CANopen® tools.

All application programming is performed through CAN interface, without disconnecting the controller from the user's system.

Besides reading data transmitted on the CANopen® bus, the controller can also transmit CANopen® PDO messages carrying data internally generated by the controller. This feature can be used for monitoring and debugging purposes.

3   CONTROLLER FUNCTIONAL BLOCKS

From the software prospective, the controller consists of a set of internal functional blocks, which can be individually programmed and arbitrarily connected together to achieve the required system functionality, see **Error! Reference source not found.**.
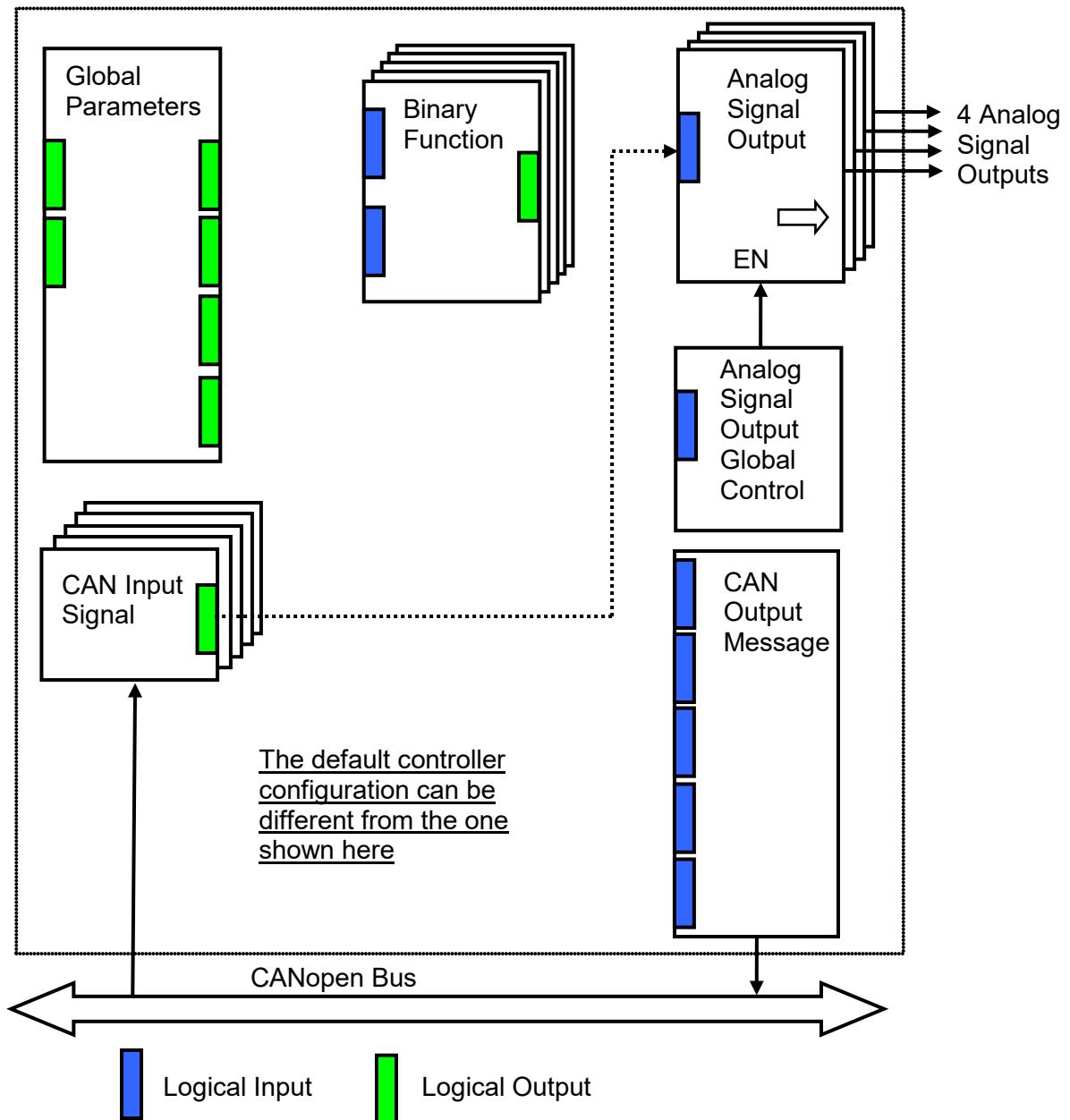
As an example, the logical output of the CAN Input Signal functional block is connected to the logical input of the Analog Signal Output functional block, providing a direct path for the CAN input signal to the controller signal output.

Figure 1: The Controller Internal Structure

Each functional block is absolutely independent and has its own set of programmable parameters, or object dictionary entries. The parameters can be viewed and changed through CAN using any commercially available CANopen® software.

There are two types of the controller functional blocks. One type represents the controller hardware resources, for example the analog signal output block. The other type is purely logical – these functional blocks are included to program the user defined functionality of the controller. The number and functional diversity of these functional blocks are only limited by the system resources of the internal microcontroller. They can be added or modified on the customer's request to accommodate user-specific requirements.

The user can build virtually any type of a custom control by logically connecting inputs and outputs of the functional blocks. This approach gives the user an absolute freedom of customization and an ability to fully utilize the controller hardware resources in a user's application.

Depending on the block functionality, a functional block can have: logical inputs, logical outputs or any combinations of them. The connection between logical inputs and outputs is defined by logical input objects. The following rules apply:
- A logical input can be connected to any logical output using a logical input object.
- Two or more logical inputs can be connected to one logical output.
- Logical outputs do not have their own objects controlling their connectivity. They can only be chosen as signal sources by logical inputs.

To provide data flow between logical inputs and outputs, all logical output signals are normalized to [0;1] data range using the following equation:

$$Yn = (Y - Ymin) / (Ymax - Ymin),$$

where: Yn – normalized output value,
 Y – original output value,
 Ymax – maximum output value,
 Ymin – minimum output value.

The original output values are restored, if necessary, at the logical inputs using the following reverse linear transformation:

$$X = Xn \cdot (Xmax - Xmin) + Xmin,$$

where: X – original restored input value,
 Xn – normalized input value, Xn=Yn,
 Xmax – maximum input value, Xmax=Ymax,
 Xmin – minimum input value, Xmin=Ymin.

All functional blocks have (Xmax, Xmin) and (Ymax, Ymin) object pairs controlling the normalization process. They will be called "normalization parameters" further in the object dictionary descriptions.

For additional flexibility, in a majority of functional blocks, logical input signals can be inverted using the following inversion function:

$$Inv(Xn,I), I \in \{Yes,No\},$$

$$Inv(Xn,I)=\{1\text{-}Xn, \text{ if } I=Yes; Xn, \text{ if } I=No\}$$

In addition to signal values in the range of [0;1], the logical inputs and outputs also carry information on the state of the data source. This information can show that the source is not available or there is an error in data, or the data source is in a special state.

When the data source does not carry a valid data, the output signal value is always set to 0 and the inversion operation on the signal in suppressed. In this case, instead of the signal value, the logical signal carries a signal state code, associated with its signal state, see the table below:

Table 1: Internal Signal State

Signal State	Signal Value, Xn	Signal State Code	Inverted Signal Value	
			Xn'=Inv(Xn,Yes)	Xn'=Inv(Xn,No)
Valid Data	[0;1]	0	1-Xn	Xn
Special	0	0…4294967295 (0…0xFFFFFFFF) – Special State Code	0	0
Error	0	0…4294967295 (0…0xFFFFFFFF) – Error Code	0	0
Not Available	0	0	0	0

The states of the data source other than the "Valid Data" are primary used by CAN functional blocks to report that a CAN input signal is absent on the bus, is out of range, etc. Other functional blocks usually use only the "Error" state to show an error condition.

3.1 Analog Signal Output

There are four Analog Signal Output functional blocks representing analog signal outputs of the controller. Each functional block can be programmed to output voltage or current in the user-specified range. All output signals can be globally enabled or disabled through the Analog Signal Output Global Control functional block.

The Analog Signal Output functional block has one logical input receiving a normalized signal to be output from the physical signal output. It is internally connected with the Analog Signal Output Global Control functional block, which enables or disables all physical outputs.
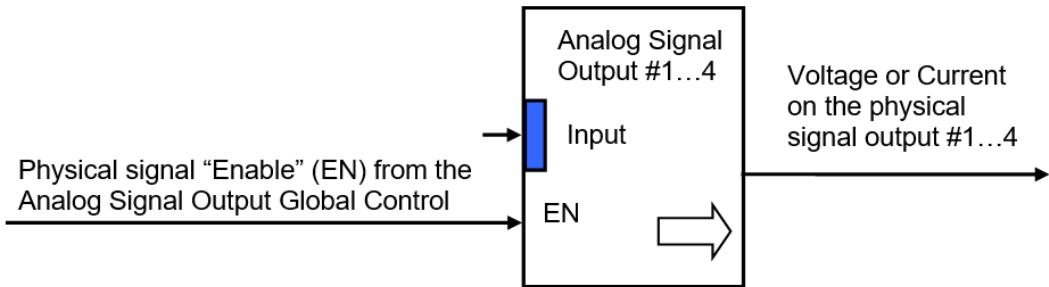
Figure 2: Analog Output Signal

The functional block parameters are presented in the following table:

Table 2: Output Functional Block Parameters

Name	Default Value	Range	Units	Description
Input Source	CAN Input Signal #1…4[1]	Any logical output of any functional block or "Not Connected"	–	Defines an input signal source of the analog signal output.
Input Inversion	No	{Yes, No}	–	Defines whether the input signal from the Input Source is inverted.
Output Mode	Output Voltage	{Output Voltage, Output Current}	–	Specifies an output mode of the analog signal output.
Vmax – Maximum Output Voltage	5000	[-10000…10000], but Vmax>Vmin	mV	Normalization parameters for Output Voltage mode.
Vmin – Minimum Output Voltage	0	[-10000…10000], but Vmin<Vmax	mV	
Imax – Maximum Output Current	20000	[-20000…20000], but Imax>Imin	uA	Normalization parameters for Output Current mode.
Imin – Minimum Output Current	4000	[-20000…20000], but Imin<Imax	uA	

[1] CAN Input Signal number is the same as the number of the Analog Signal Output functional block.
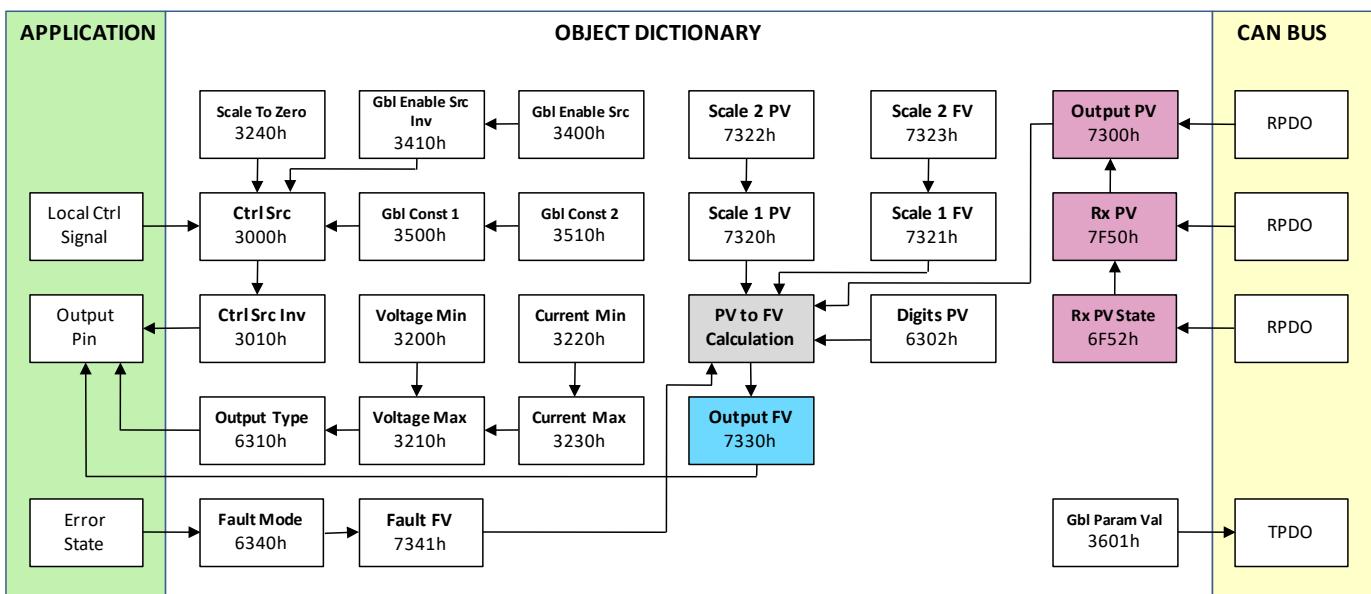
Figure 3: Analog Output Block

Table 3: Available Control Sources

Name	Value	Description
No Source	0	Output disabled
Binary Function 1	1	Binary function 1 output
Binary Function 2	2	Binary function 2 output
Binary Function 3	3	Binary function 3 output
Binary Function 4	4	Binary function 4 output
Binary Function 5	5	Binary function 5 output
CAN Input 1	6	CAN FV/PV, subindex 1
CAN Input 2	7	CAN FV/PV, subindex 2
CAN Input 3	8	CAN FV/PV, subindex 3
CAN Input 4	9	CAN FV/PV, subindex 4
CAN Input 5	10	CAN FV/PV, subindex 5
Global VS	11	Measured operating voltage*
Global Temp	12	Measured chip temperature
Global Const 1	13	Constant value 1, 3500h
Global Const 2	14	Constant value 2, 3510h
Constant '0'	15	0
Constant '1'	16	1
Floating point CAN Input 1	17	FLOAT32 CAN FV/PV, subindex 1
Floating point CAN Input 2	18	FLOAT32 CAN FV/PV, subindex 2
Floating point CAN Input 3	19	FLOAT32 CAN FV/PV, subindex 3
Floating point CAN Input 4	20	FLOAT32 CAN FV/PV, subindex 4
Floating point CAN Input 5	21	FLOAT32 CAN FV/PV, subindex 5

*VPS measurement is disabled due to a hardware limitation

Object 3240h can be used to scale the output voltage value when the device is set to a non-operational state. By default, the scaling is set as in use. This means that if the output voltage minimum (3200h) is set to a negative value, the output defaults to 0V when the device is not operational. **If the scaling is disabled, the output is set to a value equal to output voltage minimum when the device is not operational.**

3.2   Analog Signal Output Global Control

The Analog Signal Output Global Control functional block is used to globally enable or disable all analog signal outputs of the controller. It has one logical input to control the outputs.
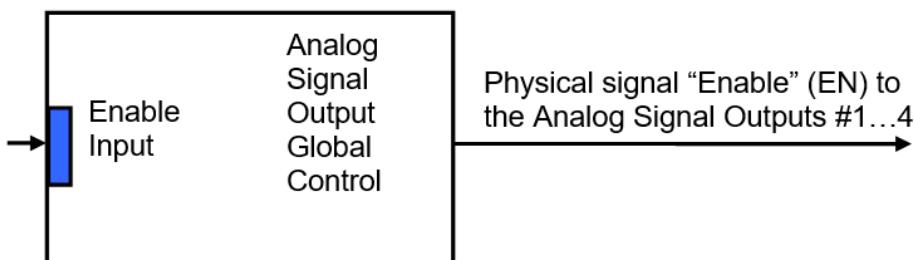
Figure 4: Global control for output

The functional block parameters are defined as follows:

Table 4: Global Enable Parameters

Name	Default Value	Range	Units	Description
Enable Input Source	Constant Output = 1.0	Any logical output of any functional block or "Not Connected"	–	Defines an input signal source to enable all signal outputs.
Enable Input Inversion	No	{Yes, No}	–	Defines whether the input signal from the Enable Input Source is inverted.

The Enable Input is connected to the Constant Output = 1.0 to enable all analog signal outputs by default.

3.3 Binary Function

There are five Binary Function functional blocks added to the controller to support advanced CAN signal monitoring algorithms. Each Binary Function functional block takes two logical input signals, scales them, and performs an arithmetic or logical operation. Then it outputs the result, which can be scaled as well.
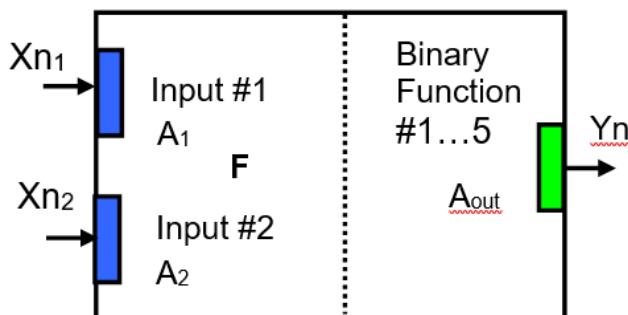
Figure 5: Binary Function

The normalized output signal Yn of the Binary Function functional block can be presented by the following formula:

$$Yn = Clip(Y),$$

$$Y = A_{out} \cdot F[A_1 \cdot Xn_1, A_2 \cdot Xn_2],$$

where:

Clip(Y)={Y, if $0 \leq Y \leq 1$; 0, if Y<0; 1, if Y>1} – clipping function;
Xn_1, Xn_2 – normalized signal values of the input sources (can be inverted);
A_1, A_2 – input scale coefficients;
A_{out} – output scale coefficient;
$F[x, y]$ – binary function of the scaled input signals: $x=A_1 \cdot Xn_1$, $y=A_2 \cdot Xn_2$.

In case one of the input sources is not connected, the output signal of the functional block is not available and its signal value is equal to Yn=0.

Table 5: Binary Function Block Parameters

Name	Default Value	Range	Units	Description
Input #1 Source	Not Connected	Any logical output of any functional block or "Not Connected"	–	Source of the input #1 signal
Input #1 Inversion	No	{Yes, No}	–	Specifies, whether to invert the input #1 signal
Input #1 Scale	1.0	[-1…1]	–	Input #1 signal scale coefficient
Input #2 Source	Not Connected	Any logical output of any functional block or "Not Connected"	–	Source of the input #2 signal
Input #2 Inversion	No	{Yes, No}	–	Specifies, whether to invert the input #2 signal
Input #2 Scale	1.0	[-1…1]	–	Input #2 signal scale coefficient
Function	+	{+, $*$,÷, Max, Min, OR, AND, XOR, <, $\leq$, =, >, $\geq$}	–	Binary function of the input #1 scaled signal and the input #2 scaled signal
Output Scale	1.0	[-1…1]	–	Output signal scale coefficient

The binary functions F[x,y] have the following implementation specifics.

In the division function, to avoid ambiguity in dividing by 0, the dividend and the divisor are not allowed to be less than δ:

$$F^{(\div)} [x,y] = \max(x,\delta)/ \max(y,\delta),$$

where: δ =1.0E-6 is a specially introduced computational constant.

For logical functions {OR, AND, XOR} values $X_i \geq 0.5$ (i=1,2) are treated as 1 (true) and $X_i < 0.5$ – as 0 (false).

To minimize influence of computational errors during normalization, comparison functions {$\leq$, =, $\geq$ } are defined the following way:

$$F^{(\leq)} [x,y] = \{1, \text{ if } x \leq y+\delta; 0, \text{ if } x> y+\delta \},$$

$$F^{(=)} [x,y] = \{1, \text{ if } |x-y|\leq \delta; 0, \text{ if } |x-y|> \delta\},$$

$$F^{(\geq)} [x,y] = \{1, \text{ if } x\geq y-\delta; 0, \text{ if } x< y-\delta \}.$$
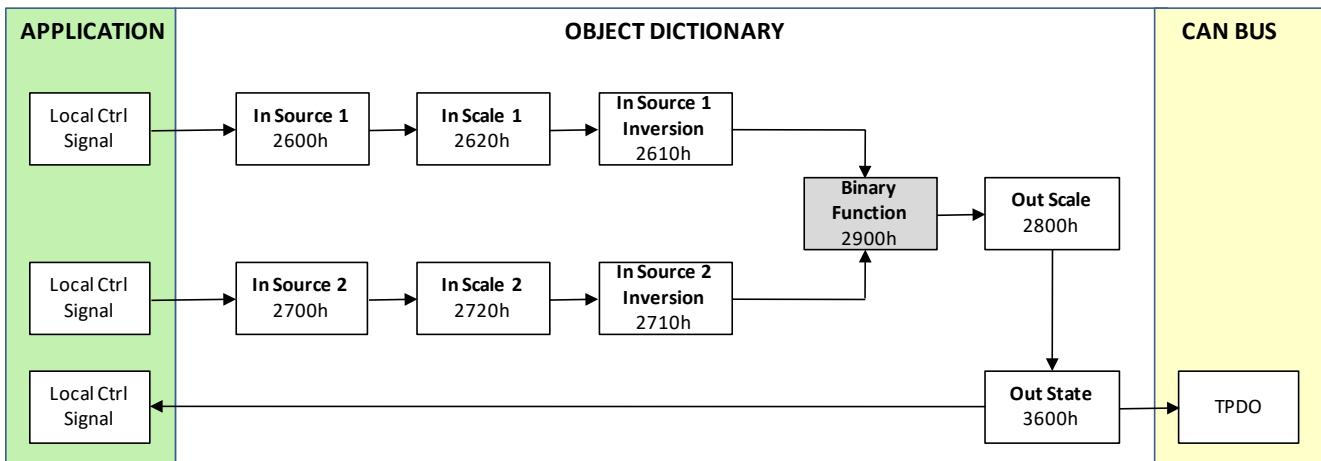
Figure 6: Binary Function Block

Table 6: Binary Functions (2900h)

Name	Value	Description
Add	0	<In 1> **+** <In 2>
Multiplication	1	<In 1> ***** <In 2>
Division	2	<In 1> **/** <In 2>
Maximum	3	Max(<In 1>,<In 2>)
Minimum	4	Min(<In 1>,<In 2>)
OR (binary)	5	<In 1> **||** <In 2>
AND (binary)	6	<In 1> **&&** <In 2>
XOR (binary)	7	<In 1> **^** <In 2>
Less Than	8	<In 1> **<** <In 2>
Less or Equal	9	<In 1> **<=** <In 2>
Equal	10	<In 1> **==** <In 2>
Greater Then	11	<In 1> **>** <In 2>
Greater or Equal	12	<In 1> **>=** <In 2>

3.4 Global Parameters

The Global Parameters functional block gives the user access to the microcontroller internal temperature as well as to a set of four constant logical outputs. These outputs can be used by other functional blocks as constant input sources. For example, they can be used to set up threshold values in Binary Function functional blocks.
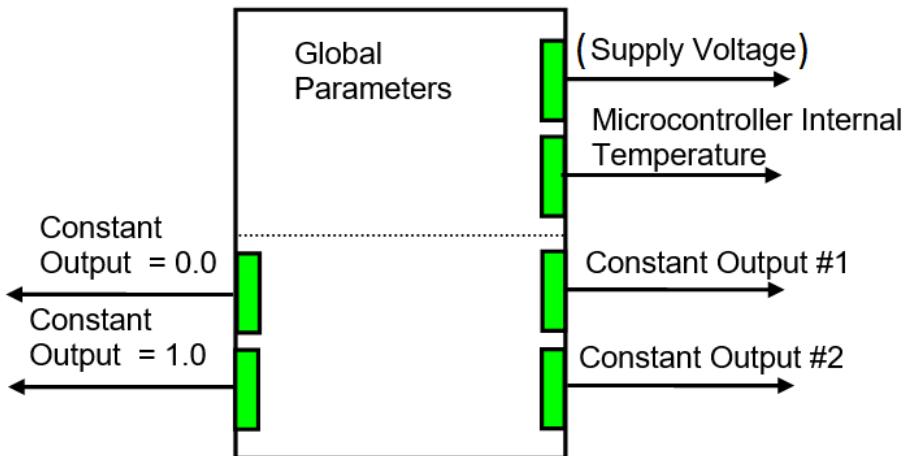
Figure 7: Global parameters

Two out of four constant logical outputs are user programmable. Other two represent logical one and logical zero outputs.

Please note that the controller supply voltage sensing circuit is available only in some controllers. If the sensing circuit is absent, the controller supply voltage logical output is set to the data not available state.

The parameters for the Global Parameters functional block are presented in the following table:

Table 7: Global Parameters

Name	Default Value	Range	Units	Description
Constant Output #1	0.0	[0…1]	–	Logical output with a constant value.
Constant Output #2	0.0	[0…1]	–	Logical output with a constant value.
Vsmax – Max Supply Voltage	70	–	V	Normalization parameters for the inclinometer supply voltage. Read only parameters.*
Vsmin – Min Supply Voltage	0	–	V	
Tmax – Max Microcontroller Temperature	150	–	°C	Normalization parameters for the microcontroller embedded temperature sensor. Read only parameters.
Tmin – Min Microcontroller Temperature	-50	–	°C	

*VPS measurement is disabled due to a hardware limitation

3.5 CAN Input and Output Signals

There are five Integer16 type CAN Input Signal functional blocks and five Float32 type CAN Input Signal blocks supported by the controller. Each functional block can be programmed to receive PDOs and extract CAN data presented in virtually any user-defined signal data format. The functional block then outputs the signal data to its logical output for processing by other functional blocks of the controller.
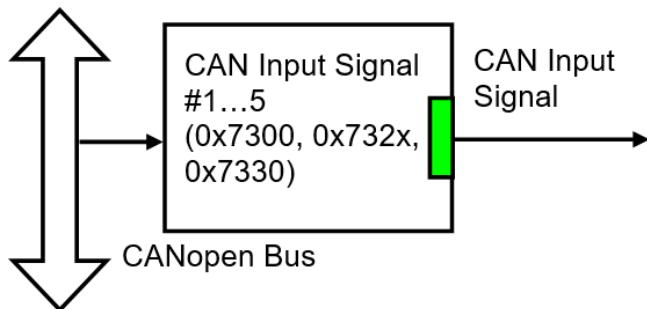
Figure 8: CAN Input Signals
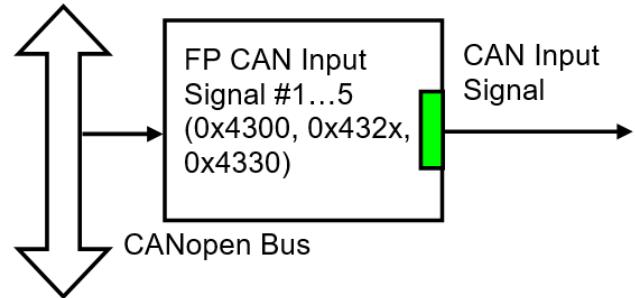
Figure 9: Floating point CAN Input signals

CAN Input Signal Blocks can be supplied with data using the 5 subindices of various Analog Output related objects in the Application –part of the object dictionary. By default the first four subindices (namely CAN Input Signal Blocks 1 to 4) map directly to outputs 1 to 4 (see Object 3000h: AO Output Control Source), however the order can be changed. The fifth subindex is included to provide closer match to the J1939 version of the product (AX030500).

See Object 7300h: AO Output Process Value, Object 7320h: AO Output Scaling 1 PV, Object 7321h: AO Output Scaling 1 FV, Object 7322h: AO Output Scaling 2 PV, Object 7323h: AO Output Scaling 2 FV, Object 7330h: AO Output Field Value, Object 7F50h: Received PV 16 and Object 6F52h: Received PV Status for more detailed description of the CAN Input Signal functional block parameters.

The floating point CAN Input signals use the objects Object 4300h: FP AO Output Process Value, Object 4320h: FP AO Output Scaling 1 PV, Object 4321h: FP AO Output Scaling 1 FV, Object 4322h: FP AO Output Scaling 2 PV, Object 4323h: FP AO Output Scaling 2 FV, Object 4330h: FP AO Output Field Value, Object 4F50h: Received PV, FP and Object 3F52h: Received PV Status for more detailed description of the floating point CAN Input Signal functional block parameters.

4 CONTROLLER ARCHITECTURE

The CANopen® object dictionary of the 4 Analog Signal Output CAN Controller is based on CiA device profile DS-404 (Device profile for measurement devices and closed-loop controllers). The object dictionary also includes some manufacturer-specific objects for extended functionality.

4.1 COMMUNICATION OBJECTS

The communication objects supported by the 4 Analog Signal Output Channel CAN Controller are listed in the following table. A more detailed description of some of the objects is given in the following subchapters. Only those objects that have device-profile specific information are described. For more information on the other objects, refer to the generic CANopen® protocol specification DS-404.

Index (hex)	Object	Object Type	Data Type	Access	PDO Mapping
1000	Device Type	VAR	UNSIGNED32	RO	No
1001	Error Register	VAR	UNSIGNED8	RO	No
1002	Manufacturer Status Register	VAR	UNSIGNED32	RO	No
1003	Pre-Defined Error Field	ARRAY	UNSIGNED32	RO	No
100B	Node-ID	VAR	UNSIGNED8	RO	No
100C	Guard Time	VAR	UNSIGNED16	RW	No
100D	Life Time Factor	VAR	UNSIGNED8	RW	No
1010	Store Parameters	ARRAY	UNSIGNED32	RW	No
1011	Restore Default Parameters	ARRAY	UNSIGNED32	RW	No
1016	Consumer Heartbeat Time	ARRAY	UNSIGNED32	RW	No
1017	Producer Heartbeat Time	VAR	UNSIGNED16	RW	No
1018	Identity Object	RECORD		RO	No
1020	Verify Configuration	ARRAY	UNSIGNED32	RW	No
1029	Error Behavior	ARRAY	UNSIGNED8	RW	No
102A	Slew Rate	VAR	UNSIGNED8	RW	No
1400	RPDO1 Communication Parameter	RECORD		RW	No
1401	RPDO2 Communication Parameter	RECORD		RW	No
1402	RPDO3 Communication Parameter	RECORD		RW	No
1403	RPDO4 Communication Parameter	RECORD		RW	No
1600	RPDO1 Mapping Parameter	RECORD		RW	No
1601	RPDO2 Mapping Parameter	RECORD		RW	No
1602	RPDO3 Mapping Parameter	RECORD		RW	No
1603	RPDO4 Mapping Parameter	RECORD		RW	No
1800	TPDO1 Communication Parameter	RECORD		RW	No
1801	TPDO2 Communication Parameter	RECORD		RW	No
1802	TPDO3 Communication Parameter	RECORD		RW	No
1803	TPDO4 Communication Parameter	RECORD		RW	No
1A00	TPDO1 Mapping Parameter	RECORD		RW	No
1A01	TPDO2 Mapping Parameter	RECORD		RW	No
1A02	TPDO3 Mapping Parameter	RECORD		RW	No
1A03	TPDO4 Mapping Parameter	RECORD		RW	No

4.1.1 PDO Parameters

All RPDOs and TPDOs in the 4 Analog Signal Output Channel CAN Controller use the same default communication parameters, respectively. The PDO IDs are set according to the pre-defined connection set described in [DS-301]. All receive PDOs are set to transmission type 255, and all transmit PDOs to transmission type 254, with the event timer (subindex 5) set to 100 (100ms).

All PDOs are dynamically mappable, and the user can therefore change the mapping of the PDOs. The granularity is 8-bits, so the objects can be mapped with byte offsets. The mapping parameter records include 8 subindexes for receive and for transmit for the PDO mapping. The default PDO mappings are listed in the following tables.

RPDO1: default ID 0x200 + node ID

Subindex	Value	Object
0	4	Number of mapped application objects in PDO
1	0x73000110	Process Value, Output 1
2	0x73000210	Process Value, Output 2
3	0x73000310	Process Value, Output 3
4	0x73000410	Process Value, Output 4
5	0	
6	0	
7	0	
8	0	

RPDO2: default ID 0x300 + node ID

Subindex	Value	Object
0	1	Number of mapped application objects in PDO
1	0x73000510	Process Value, Output 5
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

RPDO3: default ID 0x400 + node ID

Subindex	Value	Object
0	0	Number of mapped application objects in PDO
1	0x6F520108	Received PV Status, Output 1
2	0x6F520208	Received PV Status, Output 2
3	0x6F520308	Received PV Status, Output 3
4	0x6F520408	Received PV Status, Output 4
5	0x6F520508	Received PV Status, Output 5
6	0	
7	0	
8	0	

RPDO4: default ID 0x500 + node ID

Subindex	Value	Object
0	0	Number of mapped application objects in PDO
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

TPDO1: default ID 0x180 + node ID

Subindex	Value	Object
0	2	Number of mapped application objects in PDO
1	0x36010120	Board operating voltage
2	0x36010220	Board temperature
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

TPDO2: default ID 0x280 + node ID

Subindex	Value	Object
0	0	Number of mapped application objects in PDO
1	0x36000120	Binary function 1 output
2	0x36000220	Binary function 2 output
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

TPDO3: default ID 0x380 + node ID

Subindex	Value	Object
0	0	Number of mapped application objects in PDO
1	0x36000320	Binary function 3 output
2	0x36000420	Binary function 4 output
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

TPDO4: default ID 0x480 + node ID

Subindex	Value	Object
0	0	Number of mapped application objects in PDO
1	0x36000520	Binary function 5 output
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	

4.1.2 Object 1000h: Device Type

This object contains information about the device type as per device profile DS-404 (measurement devices and closed-loop controllers). The value stored in this object is 0x00080194, indicating that the 4 Analog Signal Output CAN Controller includes the following function blocks defined in the device profile.

- Analog Output (AO)

Object Description

Index	1000h
Name	Device Type
Object Type	VAR
Data Type	UNSIGNED32

Entry Description

Access	RO
PDO Mapping	No
Value Range	0x00080194
Default Value	0x00080194

4.1.3 Object 1001h: Error Register

This object is an error register for the device. Any time there is an error detected by the 4 Analog Signal Output CAN Controller, the Generic Error Bit (bit 0) is set. Only if there are no errors in the module will this bit be cleared. The Single Channel CAN Controller uses no other bits in this register.

Object Description

Index	1001h
Name	Error Register
Object Type	VAR
Data Type	UNSIGNED16

Entry Description

Access	RO
PDO Mapping	No
Value Range	00h or 01h
Default Value	0

4.1.4 Object 1002h: Manufacturer Status Register

This object is used for manufacturer debug purposes.

4.1.5 Object 1003h: Pre-Defined Error Field

The object 1003h provides an error history by listing the errors in the order that they have occurred. An error is added to the top of the list when it occurs, and is immediately removed when the error condition has been cleared. The latest error is always at subindex 1, with subindex 0 containing the number of errors currently in the list. When the device is in an error-free state, the value of subindex 0 is zero.

The error list may be cleared by writing a zero to subindex 0, which will clear all errors from the list, regardless of whether or not they are still present. Clearing the list does NOT mean that the module will return to the error-free behaviour state if at least one error is still active.

The 4 Analog Signal Output CAN Controller has a limitation of a maximum of 8 errors in the list. If the device registers more errors, the list will be truncated, and the oldest entries will be lost.

The error codes stored in the list are 32-bit unsigned numbers, consisting of two 16-bit fields. The lower 16-bit field is the EMCY error code, and the higher 16-bit field is a manufacturer-specific code. The manufacturer-specific code is divided into two 8-bit fields, with the higher byte indicating the error description, and the lower byte indicating the channel number where the error occurred.

Note, that because of the hardware implementation specific details of the Analog Outputs, the only errors detected by the 4AOUT are CANopen® communications specific.

Table 8: 4AOUT EMCY codes

Error Field Code	Error Description	Meaning	ID	Meaning	EMCY Code	Meaning
00000000h	EMCY Error Reset (fault no longer active)					
00008100h	00h	RPDO Timeout	00h	Unspecified	8100h	Communication - generic
10008130h	10h	Lifeguard Event	00h	Unspecified	8130h	Lifeguard/Heartbeat Error
80nn8130h	80h	Heartbeat Timeout	nn	Node-ID	8130h	Lifeguard/Heartbeat Error

Object Description

Index	1003h
Name	Pre-Defined Error Field
Object Type	VAR
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	0 to 16
Default Value	0

Subindex	1h to 10h
Description	Standard error field
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0

4.1.6 Object 100Bh: Node-ID

This object contains the CANopen® node-ID of the 4 Analog Signal Output CAN Controller.

Object Description

Index	100Bh
Name	Node-ID
Object Type	VAR

Data Type	UNSIGNED8

Subindex	0h
Description	Node-ID
Access	RO
PDO Mapping	No
Value Range	0x7F
Default Value	0x7F

4.1.7 Object 100Ch: Guard Time

The objects at index 100Ch and 10Dh shall indicate the configured guard time respective to the life time factor. The life time factor multiplied with the guard time gives the life time for the life guarding protocol described in DS-301. The Guard Time value shall be given in multiples of ms, and a value of 0000h shall disable the life guarding.

It should be noted that this object, and that of 100Dh are only supported for backwards compatibility. The standard recommends that newer networks do not use life guarding protocol, but rather heartbeat monitoring instead. Both life guarding and heartbeats can NOT be active simultaneously.

Object Description

Index	100Ch
Name	Guard Time
Object Type	VAR
Data Type	UNSIGNED16

Subindex	0h
Access	RW
PDO Mapping	No
Value Range	0 to 65536
Default Value	0

4.1.8 Object 100Dh: Lifetime Factor

The life time factor multiplied with the guard time gives the life time for the life guarding protocol. A value of 00h shall disable life guarding.

Object Description

Index	100Dh
Name	Lifetime factor
Object Type	VAR
Data Type	UNSIGNED8

Subindex	0h
Access	RW
PDO Mapping	No
Value Range	0 to 255
Default Value	0

4.1.9 Object 1010h: Store Parameters

This object supports the saving of parameters in non-volatile memory. In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate subindex. The signature is "save".

The signature is a 32-bit unsigned number, composed of the ASCII codes of the signature characters, according to the following table:

MSB			LSB
e	v	a	s
65h	76h	61h	73h

On reception of the correct signature to an appropriate subindex, the 4 Analog Signal Output CAN Controller will store the parameters in non-volatile memory, and then confirm the SDO transmission.

By read access, the object provides information about the 4 Analog Signal Output CAN Controller's saving capabilities.

Object Description

Index	1010h
Name	Store Parameters
Object Type	ARRAY
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Largest subindex supported
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Save all parameters
Access	RW
PDO Mapping	No
Value Range	0x65766173 (write access)/ 1h (read access)
Default Value	1h (saves parameters on command)

Subindex	2h
Description	Save communication parameters
Access	RW
PDO Mapping	No
Value Range	0x65766173 (write access) 1h (read access)
Default Value	1h (saves parameters on command)

Subindex	3h

Description	Save application parameters
Access	RW
PDO Mapping	No
Value Range	0x65766173 (write access) 1h (read access)
Default Value	1h (saves parameters on command)
Subindex	4h
Description	Save manufacturer parameters
Access	RW
PDO Mapping	No
Value Range	0x65766173 (write access) 1h (read access)
Default Value	1h (saves parameters on command)

4.1.10 Object 1011h: Restore Default Parameters

This object supports the restoring of the default values for the object dictionary in non-volatile memory. In order to avoid restoring of parameters by mistake, the device restores the defaults only when a specific signature is written to the appropriate subindex. The signature is "load".

The signature is a 32-bit unsigned number, composed of the ASCII codes of the signature characters, according to the following table:

MSB			LSB
d	a	o	l
64h	61h	6Fh	6Ch

On reception of the correct signature to an appropriate subindex, the 4 Analog Signal Output CAN Controller will restore the defaults in non-volatile memory, and then confirm the SDO transmission. The default values are set valid after the device is reset or power-cycled.

By read access, the object provides information about the 4 Analog Signal Output CAN Controller's default parameter restoring capabilities.

Object Description

Index	1011h
Name	Restore Default Parameters
Object Type	ARRAY
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Largest subindex supported
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Restore all default parameters
Access	RW
PDO Mapping	No

Value Range	0x64616F6C (write access)
	1h (read access)
Default Value	1h (restores defaults on command)

Subindex	2h
Description	Restore default communication parameters
Access	RW
PDO Mapping	No
Value Range	0x64616F6C (write access)
	1h (read access)
Default Value	1h (restores defaults on command)

Subindex	3h
Description	Restore default application parameters
Access	RW
PDO Mapping	No
Value Range	0x64616F6C (write access)
	1h (read access)
Default Value	1h (restores defaults on command)

Subindex	4h
Description	Restore default manufacturer parameters
Access	RW
PDO Mapping	No
Value Range	0x64616F6C (write access)
	1h (read access)
Default Value	1h (restores defaults on command)

4.1.11 Object 1016h: Consumer Heartbeat Time

The 4 Analog Signal Output CAN Controller can be a consumer of heartbeat objects for up to four modules. This object defines the expected heartbeat cycle time for those modules, and if set to zero, it is not used. When non-zero, the time is a multiple of 1ms, and monitoring will start after the reception of the first heartbeat from the module. If the 4 Analog Signal Output CAN Controller fails to receive a heartbeat from a node in the expected timeframe, it will indicate a communication error, and respond as per object 1029h.

Bits	31-24	23-16	15-0
Value	Reserved 00h	Node-ID	Heartbeat time
Encoded as		UNSIGNED8	UNSIGNED16

Object Description

Index	1016h
Name	Consumer heartbeat time
Object Type	ARRAY
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Number of entries
Access	RO

PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h to 4h
Description	Consumer heartbeat time
Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0

4.1.12 Object 1017h: Producer Heartbeat Time

The controller could be configured to produce a cyclical heartbeat by writing a non-zero value to this object. The value will be given in multiples of 1ms, and a value of 0 shall disable the heartbeat.

Object Description

Index	1017h
Name	Producer heartbeat time
Object Type	VAR
Data Type	UNSIGNED16

Subindex	0h
Access	RW
PDO Mapping	No
Value Range	10 to 65536
Default Value	0

4.1.13 Object 1018h: Identity Object

The identity object indicates the data of the 4 Analog Signal Output CAN Controller, including vendor id, device id, software and hardware version numbers, and the serial number.

In the Revision Number entry at subindex 3, the format of the data is as shown below

MSB			LSB
Major revision number (object dictionary)		Hardware Revision	Software Version

Object Description

Index	1018h
Name	Identity
Object Type	RECORD
Data Type	Identity Record

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Vendor ID
Access	RO
PDO Mapping	No
Value Range	0x00000055
Default Value	0x00000055 (Axiomatic)

Subindex	2h
Description	Product Code
Access	RO
PDO Mapping	No
Value Range	0xAA030501
Default Value	0xAA030501

Subindex	3h
Description	Revision Number
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	00010107

Subindex	4h
Description	Serial Number
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	No

4.1.14 Object 1020h: Verify Configuration

This object can be read to see what date the software (version identified in object 1018h) was compiled.

The date and time are represented as a hexadecimal values showing day/month/year and hour/minute/second as per the format below. The time is shown in 24h format.

MSB   LSB

Day (in 1-Byte Hex)	Month (in 1-Byte Hex)	Year (in 2-Byte Hex)	
0x00	Hour (in 1-Byte Hex)	Minute (in 1-Byte Hex)	Second (in 1-Byte Hex)

For example, a value of 0x27092010 would indicate that the software was compiled on September 27th, 2010. A value of 0x00154812 would indicate compilation took place at 15:48:12.

Object Description

Index	1020h
Name	Verify Configuration
Object Type	ARRAY
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	2
Default Value	2

Subindex	1h
Description	Configuration date
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	No

Subindex	2h
Description	Configuration time
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	0

4.1.15 Object 1029h: Error Behavior

This object controls the state that the 4 Analog Signal Output CAN Controller will be set into in case of an error of the type associated with the subindex.

Note, that there is no actual output error detection in 4AOUT. If the output is desired to be driven to a value set by AO Fault FV (7341h) in case of communication errors, the subindex of this object needs to be set to '1' (No State Change) and the subindex corresponding to the desired output of AO Fault Mode (6340h) to '1'. By default the AO Fault Mode is '0' (no action taken).

See also section 4.1.5 for more info about 4AOUT error detection.

Object Description

Index	1029h
Name	Error Behavior
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Communication Error
Access	RW
PDO Mapping	No

Value Range	0 = Pre-Operational 1 = No State Change 2 = Stopped
Default Value	0 (Pre-Operational)

Subindex	2h
Description	Digital Input Error
Access	RW
PDO Mapping	No
Value Range	0 = Pre-Operational 1 = No State Change 2 = Stopped
Default Value	1 (no state change)

Subindex	3h
Description	Analog Input Error
Access	RW
PDO Mapping	No
Value Range	0 = Pre-Operational 1 = No State Change 2 = Stopped
Default Value	1 (no state change)

Subindex	4h
Description	Digital Output Error
Access	RW
PDO Mapping	No
Value Range	0 = Pre-Operational 1 = No State Change 2 = Stopped
Default Value	1 (no state change)

Subindex	5h
Description	Analog Output Error
Access	RW
PDO Mapping	No
Value Range	0 = Pre-Operational 1 = No State Change 2 = Stopped
Default Value	1 (no state change)

4.1.16 Object 102Ah: Slew Rate

This object controls the slew rate of the CAN interface. A parameter save and reboot is needed in order to use the new value.

Object Description

Index	102Ah
Name	Slew Rate
Object Type	VAR
Data Type	UNSIGNED8

Entry Description

Access	RW
PDO Mapping	No
Value Range	0 (slow), 1 (fast)
Default Value	0

4.2 ANALOG OUTPUT FUNCTION BLOCK

The application and manufacturer objects supported by the 4 Analog Signal Output CAN Controller for the analog output block are listed in the following table.

Index (hex)	Object	Object Type	Data Type	Access	PDO Mapping
2600	Binary Funcs' Input 1 Source	ARRAY	UNSIGNED8	RW	No
2610	Binary Funcs' Input 1 Source Inv	ARRAY	UNSIGNED8	RW	No
2620	Binary Funcs' Input 1 Scale	ARRAY	FLOAT32	RW	No
2700	Binary Funcs' Input 2 Source	ARRAY	UNSIGNED8	RW	No
2710	Binary Funcs' Input 2 Source Inv	ARRAY	UNSIGNED8	RW	No
2720	Binary Funcs' Input 2 Scale	ARRAY	FLOAT32	RW	No
2800	Binary Funcs' Output Scale	ARRAY	FLOAT32	RW	No
2900	Binary Funcs' Name	ARRAY	UNSIGNED8	RW	No
3000	AO Output Control Source	ARRAY	UNSIGNED8	RW	No
3010	AO Output Control Source Inv	ARRAY	UNSIGNED8	RW	No
3200	AO Output Voltage Minimum	ARRAY	INTEGER16	RW	No
3210	AO Output Voltage Maximum	ARRAY	INTEGER16	RW	No
3220	AO Output Current Minimum	ARRAY	INTEGER16	RW	No
3230	AO Output Current Maximum	ARRAY	INTEGER16	RW	No
3240	Scale Output To Zero	ARRAY	UNSIGNED8	RW	No
3400	Global Enable Input Source	VARIABLE	UNSIGNED8	RW	No
3410	Global Enable Input Source Inv	VARIABLE	UNSIGNED8	RW	No
3500	Global Constant Output Source 1	VARIABLE	FLOAT32	RW	No
3510	Global Constant Output Source 2	VARIABLE	FLOAT32	RW	No
3600	Binary Funcs' Output Values	ARRAY	FLOAT32	RO	Yes
3601	Global Parameter Values	ARRAY	FLOAT32	RO	Yes
4300	FP AO Output Process Value	ARRAY	FLOAT32	RW	Yes
4320	FP AO Output Scaling 1 PV	ARRAY	FLOAT32	RW	No
4321	FP AO Output Scaling 1 FV	ARRAY	FLOAT32	RW	No
4322	FP AO Output Scaling 2 PV	ARRAY	FLOAT32	RW	No
4323	FP AO Output Scaling 2 FV	ARRAY	FLOAT32	RW	No
4330	FP AO Output Field Value	ARRAY	FLOAT32	RO	Yes
4341	FP AO Fault FV	ARRAY	FLOAT32	RW	No
4F50	Received PV, FP	ARRAY	FLOAT32	RW	Yes
3F52	Received FP PV Status	ARRAY	UNSIGNED8	RW	Yes
5555	Start in Operational Mode	VARIABLE	UNSIGNED8	RW	No
55AA	Start Bootloader	VARIABLE	UNSIGNED8	RW	No
6302	AO Decimal Digits PV	ARRAY	UNSIGNED8	RW	No
6310	AO Output Type	ARRAY	UNSIGNED8	RW	No
7300	AO Output Process Value	ARRAY	INTEGER16	RW	Yes
7320	AO Output Scaling 1 PV	ARRAY	INTEGER16	RW	No
7321	AO Output Scaling 1 FV	ARRAY	INTEGER16	RW	No
7322	AO Output Scaling 2 PV	ARRAY	INTEGER16	RW	No
7323	AO Output Scaling 2 FV	ARRAY	INTEGER16	RW	No
7330	AO Output Field Value	ARRAY	INTEGER16	RO	Yes
6340	AO Fault Mode	ARRAY	UNSIGNED16	RW	No
7341	AO Fault FV	ARRAY	INTEGER16	RW	No
7F50	Received PV 16	ARRAY	INTEGER16	RW	Yes
6F52	Received PV Status	ARRAY	UNSIGNED8	RW	Yes

4.2.1 Object 2600h: Binary Functions' Input 1 Source

This object is used to select the input source for binary function blocks' input 1. See Table 3 for a list of all available input sources accepted by this object.

Object Description

Index	2600h
Name	Binary Function Input 1 Source
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 1 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	2h
Description	Binary Function 2 Input 1 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	3h
Description	Binary Function 3 Input 1 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	4h
Description	Binary Function 4 Input 1 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	5h
Description	Binary Function 5 Input 1 Source

Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

4.2.2 Object 2610h: Binary Functions' Input 1 Source Inversion

This object is used to select the input source inversion for binary function blocks' input 1.

Object Description

Index	2610h
Name	Binary Function Input 1 Source Inv
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 1 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	2h
Description	Binary Function 2 Input 1 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	3h
Description	Binary Function 3 Input 1 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	4h
Description	Binary Function 4 Input 1 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	5h
Description	Binary Function 5 Input 1 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

4.2.3 Object 2620h: Binary Functions' Input 1 Scale

This object is used to select the input scale for binary function blocks' input 1.

Object Description

Index	2620h
Name	Binary Function Input 1 Scale
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 1 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	2h
Description	Binary Function 2 Input 1 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	3h
Description	Binary Function 3 Input 1 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	4h
Description	Binary Function 4 Input 1 Scale
Access	RW

PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	5h
Description	Binary Function 5 Input 1 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

4.2.4 Object 2700h: Binary Functions' Input 2 Source

This object is used to select the input source for binary function blocks' input 1. See Table 3 for a list of all available input sources accepted by this object.

Object Description

Index	2700h
Name	Binary Function Input 2 Source
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 2 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	2h
Description	Binary Function 2 Input 2 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	3h
Description	Binary Function 3 Input 2 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	4h
Description	Binary Function 4 Input 2 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

Subindex	5h
Description	Binary Function 5 Input 2 Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	0 (No source)

4.2.5 Object 2710h: Binary Functions' Input 2 Source Inversion

This object is used to select the input source inversion for binary function blocks' input 2.

Object Description

Index	2710h
Name	Binary Function Input 2 Source Inv
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 2 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	2h
Description	Binary Function 2 Input 2 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	3h
Description	Binary Function 3 Input 2 Source Inv
Access	RW

PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	4h
Description	Binary Function 4 Input 2 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	5h
Description	Binary Function 5 Input 2 Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

4.2.6 Object 2720h: Binary Functions' Input 2 Scale

This object is used to select the input scale for binary function blocks' input 2.

Object Description

Index	2720h
Name	Binary Function Input 2 Scale
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Input 2 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	2h
Description	Binary Function 2 Input 2 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	3h
Description	Binary Function 3 Input 2 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	4h
Description	Binary Function 4 Input 2 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	5h
Description	Binary Function 5 Input 2 Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

4.2.7 Object 2800h: Binary Functions' Output Scale

This object is used to select the output scale for binary function blocks.

Object Description

Index	2800h
Name	Binary Functions' Output Scale
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Output Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	2h
Description	Binary Function 2 Output Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0

Default Value	1.0

Subindex	3h
Description	Binary Function 3 Output Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	4h
Description	Binary Function 4 Output Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

Subindex	5h
Description	Binary Function 5 Output Scale
Access	RW
PDO Mapping	No
Value Range	-1.0 … 1.0
Default Value	1.0

4.2.8 Object 2900h: Binary Functions' Names

This object is used to select the name and the operation for binary function blocks. See Table 6 for a list of all available values for this object.

Object Description

Index	2900h
Name	Binary Functions' Name
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Name
Access	RW
PDO Mapping	No
Value Range	0 … 12 (see Table 6)
Default Value	0 (Addition)

Subindex	2h

Description	Binary Function 2 Name
Access	RW
PDO Mapping	No
Value Range	0 … 12 (see Table 6)
Default Value	0 (Addition)

Subindex	3h
Description	Binary Function 3 Name
Access	RW
PDO Mapping	No
Value Range	0 … 12 (see Table 6)
Default Value	0 (Addition)

Subindex	4h
Description	Binary Function 4 Name
Access	RW
PDO Mapping	No
Value Range	0 … 12 (see Table 6)
Default Value	0 (Addition)

Subindex	5h
Description	Binary Function 5 Name
Access	RW
PDO Mapping	No
Value Range	0 … 12 (see Table 6)
Default Value	0 (Addition)

4.2.9 Object 3000h: AO Output Control Source

This object is used to select the control signal for Analog Output Blocks. Valid values for this object are listed in Table 3.

Object Description

Index	3000h
Name	AO Output Control Source
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	AO Output 1 Control Source
Access	RW
PDO Mapping	No

Value Range	0 … 21 (see Table 3)
Default Value	6 (CAN FV/PV subindex 1)

Subindex	2h
Description	AO Output 2 Control Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	7 (CAN FV/PV subindex 2)

Subindex	3h
Description	AO Output 3 Control Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	8 (CAN FV/PV subindex 3)

Subindex	4h
Description	AO Output 4 Control Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	9 (CAN FV/PV subindex 4)

4.2.10 Object 3010h: AO Output Control Source Inversion

This object is used to select whether the control signal for Analog Output Blocks should be inverted.

Object Description

Index	3010h
Name	AO Output Control Source Inv
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	AO Output 1 Control Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	2h
Description	AO Output 2 Control Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	3h
Description	AO Output 3 Control Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

Subindex	4h
Description	AO Output 4 Control Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (No inversion)

4.2.11 Object 3200h: AO Voltage Minimum

This object defines the minimum voltage value for the output. This value is used in the control signal normalization process. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7320, 0x7321, 0x7322 and 0x7323) are the preferred objects for minimum and maximum values setting.

Object Description

Index	3200h
Name	AO Voltage Minimum
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Minimum voltage, OUT1
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	0

Subindex	2h

Description	Minimum voltage, OUT2
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	0

Subindex	3h
Description	Minimum voltage, OUT3
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	0

Subindex	4h
Description	Minimum voltage, OUT4
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	0

4.2.12 Object 3210h: AO Voltage Maximum

This object defines the maximum voltage value for the output. This value is used in the control signal normalization process. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7320, 0x7321, 0x7322 and 0x7323) are the preferred objects for minimum and maximum values setting.

Object Description

Index	3210h
Name	AO Voltage Maximum
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Maximum voltage, OUT1
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	5000

Subindex	2h
Description	Maximum voltage, OUT2
Access	RW

PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	5000

Subindex	3h
Description	Maximum voltage, OUT3
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	5000

Subindex	4h
Description	Maximum voltage, OUT4
Access	RW
PDO Mapping	No
Value Range	-10000 … 10000 [mV]
Default Value	5000

4.2.13 Object 3220h: AO Current Minimum

This object defines the minimum current value for the output. This value is used in the control signal normalization process. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7320, 0x7321, 0x7322 and 0x7323) are the preferred objects for minimum and maximum values setting.

Object Description

Index	3220h
Name	AO Current Minimum
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Minimum current, OUT1
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	4

Subindex	2h
Description	Minimum current, OUT2
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]

Default Value	4

Subindex	3h
Description	Minimum current, OUT3
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	4

Subindex	4h
Description	Minimum current, OUT4
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	4

4.2.14 Object 3230h: AO Current Maximum

This object defines the maximum current value for the output. This value is used in the control signal normalization process. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7320, 0x7321, 0x7322 and 0x7323) are the preferred objects for minimum and maximum values setting.

Object Description

Index	3230h
Name	AO Current Maximum
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Maximum current, OUT1
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	20

Subindex	2h
Description	Maximum current, OUT2
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	20

Subindex	3h
Description	Maximum current, OUT3
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	20

Subindex	4h
Description	Maximum current, OUT4
Access	RW
PDO Mapping	No
Value Range	-20000 … 20000 [uA]
Default Value	20

4.2.15 Object 3240h: Scale Output To Zero

When using negative voltages as minimum output voltage, this object can be used to select whether the output is scaled to zero when the device is not operational. If the output is not scaled to zero, the output will be set equal to minimum output voltage when the device is not operational.

Object Description

Index	3240h
Name	Scale Output To Zero
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Scale Output 1 To Zero
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	1

Subindex	2h
Description	Scale Output 2 To Zero
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	1

Subindex	3h
Description	Scale Output 3 To Zero

Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	1

Subindex	4h
Description	Scale Output 4 To Zero
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	1

4.2.16 Object 3400h: Global Enable Input Source

This object can be used to enable or disable all Analog Output Blocks. See section 3.2 for more details.

Object Description

Index	3400h
Name	Global Enable Input Source
Object Type	VARIABLE
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Global Enable Input Source
Access	RW
PDO Mapping	No
Value Range	0 … 21 (see Table 3)
Default Value	16 (all enabled)

4.2.17 Object 3410h: Global Enable Input Source Inversion

This object selects whether the inputs to all Analog Output Blocks should be inverted. See section 3.2 for more details.

Object Description

Index	3410h
Name	Global Enable Input Source Inv
Object Type	VARIABLE
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Global Enable Input Source Inv
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

4.2.18 Object 3500h: Global Configurable Output Constant 1

This object defines the global configurable output constant 1, which can be used as a source for Binary Function Blocks and Analog Output Blocks.

Object Description

Index	3500h
Name	Global Configurable Output Constant 1
Object Type	VARIABLE
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Global Configurable Output Constant 1
Access	RW
PDO Mapping	No
Value Range	0.0 … 1.0
Default Value	0.0

4.2.19 Object 3510h: Global Configurable Output Constant 2

This object defines the global configurable output constant 2, which can be used as a source for Binary Function Blocks and Analog Output Blocks.

Object Description

Index	3510h
Name	Global Configurable Output Constant 2
Object Type	VARIABLE
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Global Configurable Output Constant 2
Access	RW
PDO Mapping	No
Value Range	0.0 … 1.0
Default Value	0.0

4.2.20 Object 3600h: Binary Functions' Output Values

This object lists the current output values of the Binary Function Blocks. This object is read-only and targeted for debug purposes.

Object Description

Index	3600h
Name	Binary Functions' Output Values
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO

PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Binary Function 1 Output
Access	RO
PDO Mapping	Yes
Value Range	-1.0 … 1.0
Default Value	0.0

Subindex	2h
Description	Binary Function 2 Output
Access	RO
PDO Mapping	Yes
Value Range	-1.0 … 1.0
Default Value	0.0

Subindex	3h
Description	Binary Function 3 Output
Access	RO
PDO Mapping	Yes
Value Range	-1.0 … 1.0
Default Value	0.0

Subindex	4h
Description	Binary Function 4 Output
Access	RO
PDO Mapping	Yes
Value Range	-1.0 … 1.0
Default Value	0.0

Subindex	5h
Description	Binary Function 5 Output
Access	RO
PDO Mapping	Yes
Value Range	-1.0 … 1.0
Default Value	0.0

4.2.21 Object 3601h: Global Parameter Values

This object list the global parameters of the board, such as operating voltage, temperature and the two configurable coefficients' values.

Object Description

Index	3601h
Name	Global Parameter Values
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Operating voltage*
Access	RO
PDO Mapping	Yes
Value Range	[V]
Default Value	

*VPS measurement is disabled due to a hardware limitation

Subindex	2h
Description	Board temperature
Access	RO
PDO Mapping	Yes
Value Range	[°C]
Default Value	

Subindex	3h
Description	Global configurable coefficient 1
Access	RO
PDO Mapping	Yes
Value Range	0.0 … 1.0
Default Value	

Subindex	4h
Description	Global configurable coefficient 2
Access	RO
PDO Mapping	Yes
Value Range	0.0 … 1.0
Default Value	

4.2.22 Object 4300h: FP AO Output Process Value

This object is the floating point process value that is fed into the analog output function block. The process value can be in any physical unit (bar, rpm, etc.) or in any custom format. The output value is scaled into a field value in object 4330h using the scaling coefficients defined in objects 4320h to 4323h.

Object Description

Index	4300h
Name	FP AO Output Process Value
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Process Value, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	2h
Description	FP Process Value, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	3h
Description	FP Process Value, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	4h
Description	FP Process Value, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	5h
Description	FP Process Value, CAN input 5
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

4.2.23 Object 4320h: FP AO Output Scaling 1 PV

This object defines the process value for the first calibration point for the output channel. The value is scaled in the physical unit of the floating point output process value, object 4300h.

Object Description

Index	4320h
Name	FP AO Output Scaling 1 PV

Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Scaling 1 PV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	2h
Description	FP Scaling 1 PV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	3h
Description	FP Scaling 1 PV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	4h
Description	FP Scaling 1 PV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	5h
Description	FP Scaling 1 PV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

4.2.24 Object 4321h: FP AO Output Scaling 1 FV

This object defines the field value for the first calibration point for the output channel. The value is scaled in the physical unit of the floating point output field value, object 4330h.

Object Description

Index	4321h
Name	FP AO Output Scaling 1 FV
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Scaling 1 FV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	2h
Description	FP Scaling 1 FV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	3h
Description	FP Scaling 1 FV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	4h
Description	FP Scaling 1 FV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	0

Subindex	5h
Description	FP Scaling 1 FV, CAN input 5
Access	RW
PDO Mapping	No

Value Range	FLOAT32
Default Value	0

4.2.25 Object 4322h: FP AO Output Scaling 2 PV

This object defines the process value for the second calibration point for the output channel. The value is scaled in the physical unit of the floating point output process value, object 4300h.

Object Description

Index	4322h
Name	FP AO Output Scaling 2 PV
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Scaling 2 PV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	1000

Subindex	1h
Description	FP Scaling 2 PV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	1000

Subindex	1h
Description	FP Scaling 2 PV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	1000

Subindex	1h
Description	FP Scaling 2 PV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	1000

Subindex	1h
Description	FP Scaling 2 PV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	1000

4.2.26 Object 4323h: FP AO Output Scaling 2 FV

This object defines the field value for the second calibration point for the output channel. The value is scaled in the physical unit of the floating point output field value, object 4330h.

Object Description

Index	7323h
Name	FP AO Output Scaling 2 FV
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Scaling 2 FV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	5000

Subindex	2h
Description	FP Scaling 2 FV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	5000

Subindex	3h
Description	FP Scaling 2 FV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	5000

Subindex	4h
Description	FP Scaling 2 FV, CAN input 4

Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	5000

Subindex	5h
Description	FP Scaling 2 FV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	FLOAT32
Default Value	5000

4.2.27 Object 4330h: FP AO Output Field Value

This object defines the field value of the proportional outputs. The FV is automatically updated if object 4300h [FP AO Output Process Value] is changed, either by a direct write to object 4300h or by using objects 4F50h and 3F52h. The value is defined as a multiple of 1uA / 1mV. The value range of this object depends on the selected output type.

Object Description

Index	4330h
Name	FP AO Output Field Value
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Field Value, CAN input 1
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	2h
Description	FP Field Value, CAN input 2
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	3h
Description	FP Field Value, CAN input 3

Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	4h
Description	FP Field Value, CAN input 4
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	5h
Description	FP Field Value, CAN input 5
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

4.2.28 Object 4341h: FP AO Fault FV

This object defines the value that proportional outputs will be driven to in fault situations. Value range of this object depends on the selected output type. Note, that these subindices map directly into the corresponding Analog Output Blocks (1 to 4).

Object Description

Index	4341h
Name	FP AO Fault FV
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	FP Fault FV, OUT1
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	2h
Description	FP Fault FV, OUT2
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	3h
Description	FP Fault FV, OUT3
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	4h
Description	FP Fault FV, OUT4
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

4.2.29 Object 4F50h: Received PV, FP

This object is a generic input process value that is used to write to the CAN input function block's floating point process value, object 4300h. If and only if the value of object 3F52h at the same subindex is set to validate the FP PV will the data from 4F50h be copied to object 4300h. Note, that the device needs to be set to OPERATIONAL mode for writing successfully into this object.

Object Description

Index	4F50h
Name	Received PV, FP
Object Type	ARRAY
Data Type	FLOAT32

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	FP Received PV, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32

Default Value	0

Subindex	2h
Description	FP Received PV, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	3h
Description	FP Received PV, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	4h
Description	FP Received PV, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

Subindex	5h
Description	FP Received PV, CAN input 5
Access	RW
PDO Mapping	Yes
Value Range	FLOAT32
Default Value	0

4.2.30 Object 3F52h: Received PV Status

This object is used to validate the value in object 4F50h [Received PV, FP] such that the value will be copied to object 4300h [FP AO output PV] and subsequently used as the output command. If this object is set to the non-validated value, the Received PV, FP is not used. However, writes to object 4300h [FP AO Output PV] are allowed at any time, thus the field value can be used to control the CAN input blocks, even when the process values have not been validated.

The value of object 3F52h is invalidated after the value in object 4F50h is copied to 4300h. Therefore, if the object is not mapped into a PDO, the user must validate the Received PV, FP by SDO writes before the Received PV, FP will be used. Note, that the device needs to be set to OPERATIONAL mode for writing successfully into this object.

The following status values are allowed for object 3F52h.
- Value 0 = Received PV, FP value not validated (writes to object 4F50h are ignored)
- Value 1 = Received PV, FP value is validated (value in object 4F50h is copied to 4300h)

Object Description

Index	3F52h

Name	Received PV Status
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	PV Status, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV, FP invalid)

Subindex	2h
Description	PV Status, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV, FP invalid)

Subindex	3h
Description	PV Status, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV, FP invalid)

Subindex	4h
Description	PV Status, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV, FP invalid)

Subindex	5h
Description	PV Status, CAN input 5
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV, FP invalid)

4.2.31 Object 7300h: AO Output Process Value
This object is the process value that is fed into the analog output function block. The process value can be in any physical unit (bar, rpm, etc.) or in any custom format. The output value is scaled into a field value in object 7330h using the scaling coefficients defined in objects 7320h to 7323h.

Object Description

Index	7300h
Name	AO Output Process Value
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Process Value, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

Subindex	2h
Description	Process Value, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

Subindex	3h
Description	Process Value, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

Subindex	4h
Description	Process Value, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

Subindex	5h
Description	Process Value, CAN input 5
Access	RW
PDO Mapping	Yes

Value Range	INTEGER16
Default Value	0

4.2.32 Object 6302h: AO Decimal Digits PV

This object sets the number of decimal digits included in the process value.

Object Description

Index	6302h
Name	AO Decimal Digits PV
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Decimal Digits PV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

Subindex	2h
Description	Decimal Digits PV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

Subindex	3h
Description	Decimal Digits PV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

Subindex	4h
Description	Decimal Digits PV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

Subindex	5h
Description	Decimal Digits PV, CAN input 5

Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

4.2.33 Object 6310h: AO Output Type

This object defines the type of the output. The following values are allowed for this object.

- Output Type 0 = voltage output
- Output Type 1 = current output

Only the mentioned output types are supported. Writing a value other than those listed above will result in SDO abort download error, and the previous value will remain unchanged. The default value is 0, voltage output.

Object Description

Index	6310h
Name	AO Output Type
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Output Type, OUT1
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (voltage)

Subindex	2h
Description	Output Type, OUT2
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (voltage)

Subindex	3h
Description	Output Type, OUT3
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (voltage)

Subindex	4h
Description	Output Type, OUT4
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (voltage)

4.2.34 Object 7320h: AO Output Scaling 1 PV

This object defines the process value for the first calibration point for the output channel. The value is scaled in the physical unit of the output process value, object 7300h.

Object Description

Index	7320h
Name	AO Output Scaling 1 PV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Scaling 1 PV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	2h
Description	Scaling 1 PV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	3h
Description	Scaling 1 PV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	4h
Description	Scaling 1 PV, CAN input 4

Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	5h
Description	Scaling 1 PV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

4.2.35 Object 7321h: AO Output Scaling 1 FV

This object defines the field value for the first calibration point for the output channel. The value is scaled in the physical unit of the output field value, object 7330h.

Object Description

Index	7321h
Name	AO Output Scaling 1 FV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Scaling 1 FV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	2h
Description	Scaling 1 FV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	3h
Description	Scaling 1 FV, CAN input 3
Access	RW
PDO Mapping	No

Value Range	INTEGER16
Default Value	0

Subindex	4h
Description	Scaling 1 FV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

Subindex	5h
Description	Scaling 1 FV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

4.2.36 Object 7322h: AO Output Scaling 2 PV

This object defines the process value for the second calibration point for the output channel. The value is scaled in the physical unit of the output process value, object 7300h.

Object Description

Index	7322h
Name	AO Output Scaling 2 PV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Scaling 2 PV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

Subindex	2h
Description	Scaling 2 PV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

Subindex	3h
Description	Scaling 2 PV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

Subindex	4h
Description	Scaling 2 PV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

Subindex	5h
Description	Scaling 2 PV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

4.2.37 Object 7323h: AO Output Scaling 2 FV

This object defines the field value for the second calibration point for the output channel. The value is scaled in the physical unit of the output field value, object 7330h.

Object Description

Index	7323h
Name	AO Output Scaling 2 FV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Scaling 2 FV, CAN input 1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	5000

Subindex	2h

Description	Scaling 2 FV, CAN input 2
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	5000

Subindex	3h
Description	Scaling 2 FV, CAN input 3
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	5000

Subindex	4h
Description	Scaling 2 FV, CAN input 4
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	5000

Subindex	5h
Description	Scaling 2 FV, CAN input 5
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	5000

4.2.38 Object 7330h: AO Output Field Value

This object defines the field value of the proportional outputs. The FV is automatically updated if object 7300h [AO Output Process Value] is changed, either by a direct write to object 7300h or by using objects 7F50h and 6F52h. The value is defined as a multiple of 1mA / 1mV. The value range of this object depends on the selected output type.

Object Description

Index	7330h
Name	AO Output Field Value
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h

Description	Field Value, CAN input 1
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	2h
Description	Field Value, CAN input 2
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	3h
Description	Field Value, CAN input 3
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	4h
Description	Field Value, CAN input 4
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	5h
Description	Field Value, CAN input 5
Access	RO
PDO Mapping	Yes
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

4.2.39 Object 6340h: AO Fault Mode

This object defines the fault mode response for proportional outputs. It determines whether the output shall continue to operate normally when the 4 Analog Output CAN Controller detects an error, or if the output shall be driven to the value defined in object 7341h. Note, that these subindices map directly into the corresponding Analog Output Blocks (1 to 4).

- Value 0 = output continues to operate normally in controller fault state
- Value 1 = write the value defined in object 7341h in object 7330h, in controller fault state

Object Description

Index	6340h
Name	AO Fault Mode
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Fault Mode, Output 1
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

Subindex	2h
Description	Fault Mode, Output 2
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

Subindex	3h
Description	Fault Mode, Output 3
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

Subindex	4h
Description	Fault Mode, Output 4
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

4.2.40 Object 7341h: AO Fault FV

This object defines the value that proportional outputs will be driven to in fault situations. Value range of this object depends on the selected output type. Note, that these subindices map directly into the corresponding Analog Output Blocks (1 to 4).

Object Description

Index	7341h
Name	AO Fault FV

Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	4
Default Value	4

Subindex	1h
Description	Fault FV, OUT1
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	2h
Description	Fault FV, OUT2
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	3h
Description	Fault FV, OUT3
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

Subindex	4h
Description	Fault FV, OUT4
Access	RW
PDO Mapping	No
Value Range	-20000 to 20000 [uA], -10000 to 10000 [mV]
Default Value	0

4.2.41 Object 7F50h: Received PV 16

This object is a generic input process value that is used to write to the CAN input function block's process value, object 7300h. If and only if the value of object 6F52h at the same subindex is set to validate the PV will the data from 7F50h be copied to object 7300h. Note, that the device needs to be set to OPERATIONAL mode for writing successfully into this object.

Object Description

Index	7F50h
Name	Received PV 16
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	Received PV, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

Subindex	2h
Description	Received PV, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

Subindex	3h
Description	Received PV, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

Subindex	4h
Description	Received PV, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

Subindex	5h
Description	Received PV, CAN input 5
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

4.2.42 Object 6F52h: Received PV Status

This object is used to validate the value in object 7F50h [Received PV] such that the value will be copied to object 7300h [AO output PV] and subsequently used as the output command. If this object is set to the non-validated value, the Received PV is not used. However, writes to object 7300h [AO Output PV] are allowed at any time, thus the field value can be used to control the CAN output blocks, even when the process values have not been validated.

The value of object 6F52h is invalidated after the value in object 7F50h is copied to 7300h. Therefore, if the object is not mapped into a PDO, the user must validate the Received PV by SDO writes before the Received PV will be used. Note, that the device needs to be set to OPERATIONAL mode for writing successfully into this object.

The following status values are allowed for object 6F52h.
- Value 0 = Received PV value not validated (writes to object 7F50h are ignored)
- Value 1 = Received PV value is validated (value in object 7F50h is copied to 7300h)

Object Description

Index	6F52h
Name	Received PV Status
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries (NrOfObjects)
Access	RO
PDO Mapping	No
Value Range	5
Default Value	5

Subindex	1h
Description	PV Status, CAN input 1
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV invalid)

Subindex	2h
Description	PV Status, CAN input 2
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV invalid)

Subindex	3h
Description	PV Status, CAN input 3
Access	RW
PDO Mapping	Yes
Value Range	0, 1

Default Value	0 (Received PV invalid)

Subindex	4h
Description	PV Status, CAN input 4
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV invalid)

Subindex	5h
Description	PV Status, CAN input 5
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV invalid)

4.2.43 Object 5555h: Start in Operational

This manufacturer specific object allows the unit to start in Operational mode without requiring the presence of a CANopen® Master on the network. It is intended to be used only when running the controller as a stand-alone module. This should always be set FALSE whenever it is connected to a standard master/slave network.

Object Description

Index	5555h
Name	Start in Operational Mode
Object Type	VARIABLE
Data Type	BOOLEAN

Entry Description

Sub-Index	0h
Access	RW
PDO Mapping	No
Value Range	0 (FALSE) or 1 (TRUE)
Default Value	0 [FALSE]

4.2.44 Object 55AAh: Start Bootloader

The firmware update process can be started using this manufacturer specific object. For mode details and before any writes to this object, please see section FIRMWARE FLASHING.

Object Description

Index	55AAh
Name	Start Bootloader
Object Type	VARIABLE
Data Type	BOOLEAN

Entry Description

Sub-Index	0h

Access	RW
PDO Mapping	No
Value Range	0 (FALSE) or 1 (TRUE)
Default Value	0 [FALSE]

5 FIRMWARE FLASHING

5.1 Pre-requisites

<div style="background-color: yellow">

PLEASE NOTE THAT FIRMWARE REFLASHING IS NOT SUPPORTED USING 3RD PARTY CAN/CANopen® TOOLS!

</div>

The 4AOUT-CO supports firmware reflashing using **Axiomatic CAN tools only**. Before writing '1' to Object 55AAh: Start Bootloader, the following pre-requisites **MUST** be found:

1. A personal computer with a USB port running Windows operating system.
2. A firmware flash file for the 4AOUT-CO. It should have the following name: **AF-9136-x.xx.bin**, where x.xx is the firmware version number.
3. Axiomatic Electronic Assistant (EA) software, P/N: AX070500.
4. Axiomatic CAN Assistant – Scope software, P/N: AX070501SCO.
5. The Axiomatic USB-CAN Converter KIT, P/Ns: AX070502 or AX070506K. It should be connected to the USB port of the personal computer.
6. Power supply to power the controller(s).
7. Wire harness to connect the controller(s) to the power supply and to the CAN port of the Axiomatic USB-CAN converter with proper termination resistance.

5.2 Reflashing procedure

1. Connect 4AOUT-CO controller to the power supply and Axiomatic USB-CAN converter.

2. Open CAN port and start monitoring the CAN bus in CAN Assistant – Scope. Make sure that the baud rate is set to the configured CANopen® baud rate of the 4AOUT-CO controller (default: 250 kBit/s).

3. Power-up the controller. The user should see a single message from the unit followed by TPDOs and/or heartbeat messages depending on the configuration of the controller.

Please note, that the ID depends on the CANopen® node ID. The example below has node ID 0x7F:
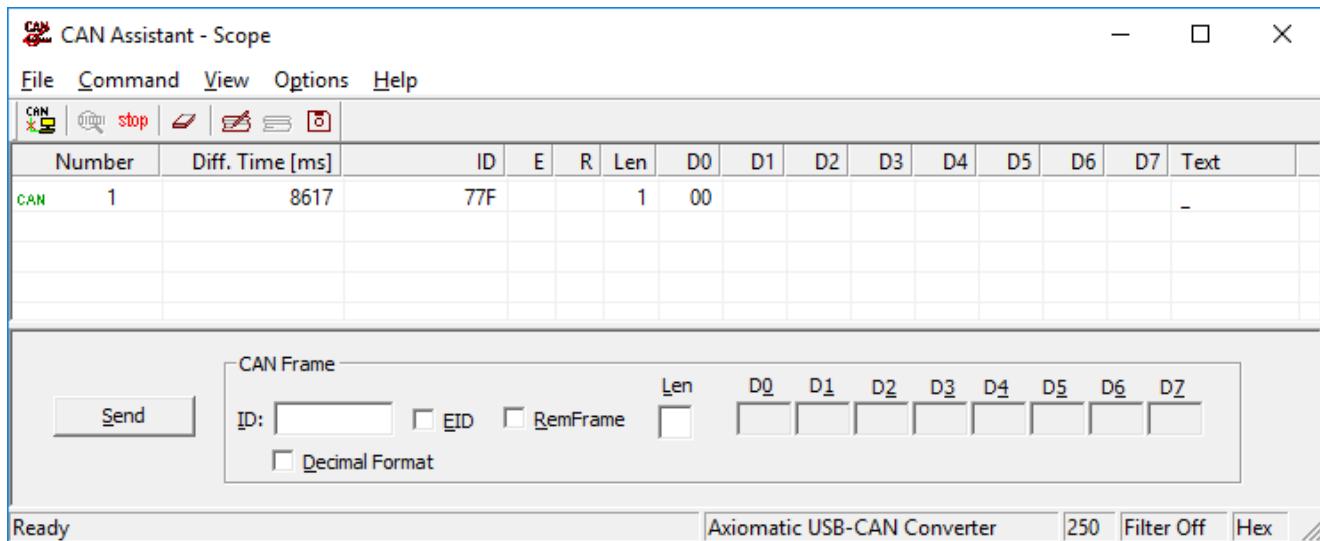
4. Set the CANopen® object 0x55AA to 1 using SDO protocol. To do so, send the following message using CAN Assistant – Scope (this example assumes node ID = 0x7F):

ID	Len	D0	D1	D2	D3	D4	D5	D6	D7
67F	8	2F	AA	55	00	01	00	00	00

If everything is correct, the controller acknowledges the writing operation and activates software reset after the message is sent.
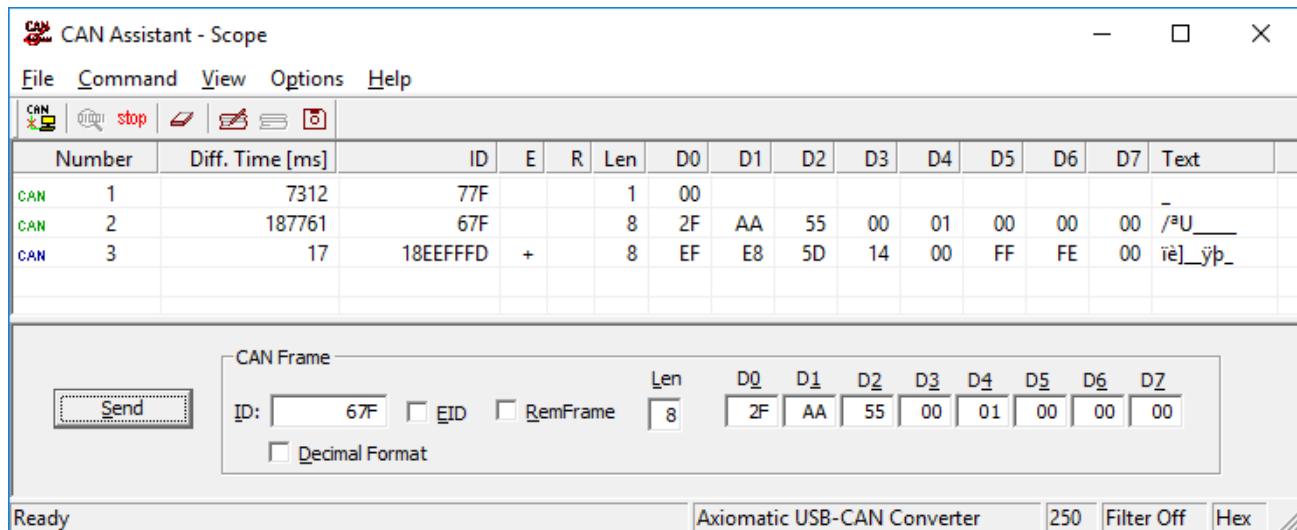
5. Run the Axiomatic Electronic Assistant (EA) software and connect to the CAN port. The user should see the following screen:
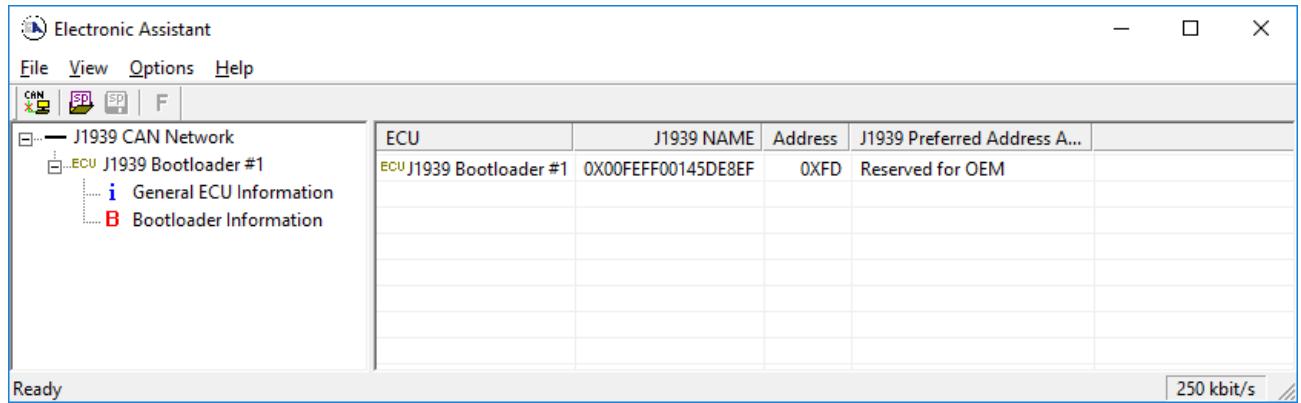
6. Click on the *Bootloader Information* group in the left pane and then on the *F* button in the Axiomatic EA toolbar. Select the flash file:
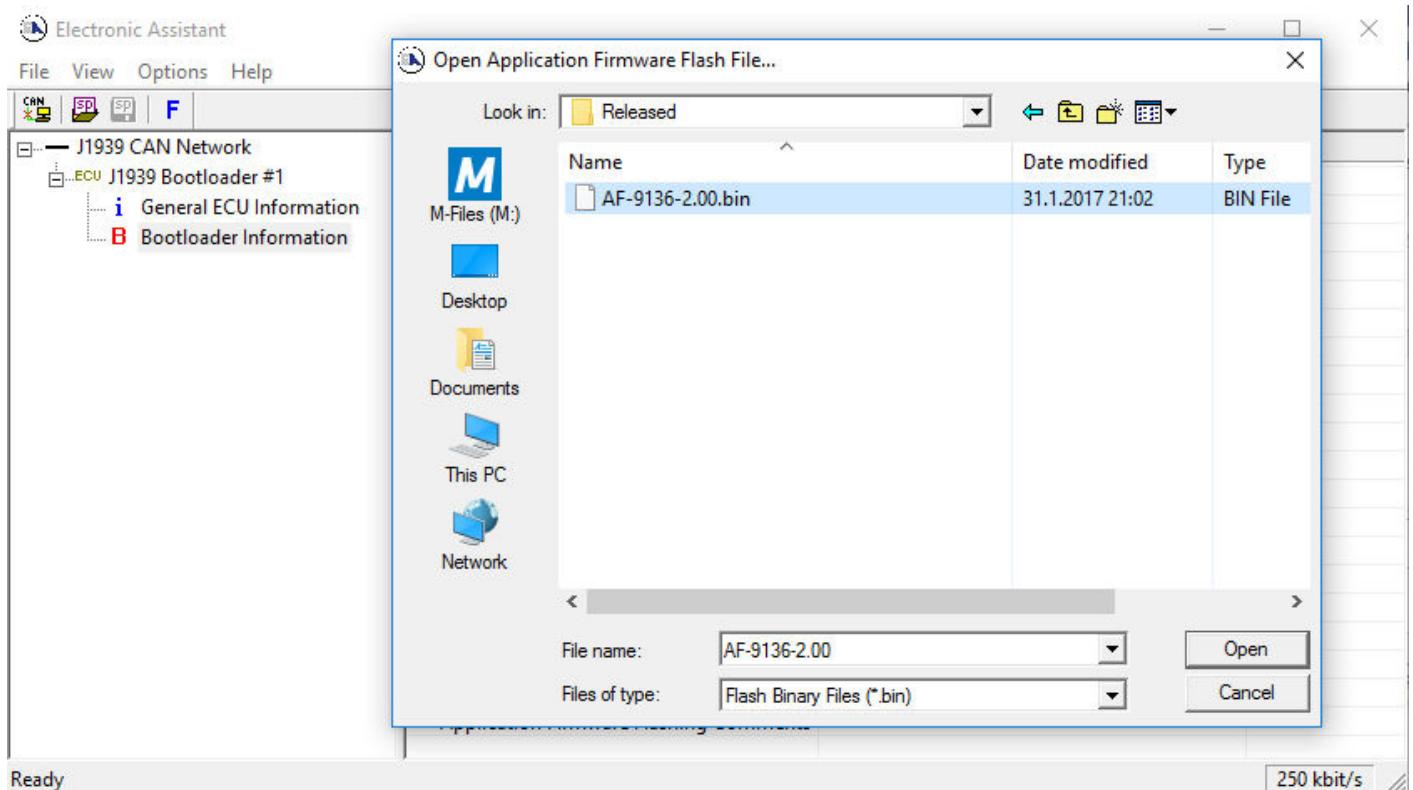
7. Open the flash file and start flashing operation by pressing the *Flash ECU* button. Optionally, the user can write their comments in the *Flashing Comments* field.

   Make sure *Erase All ECU Flash Memory* is checked:
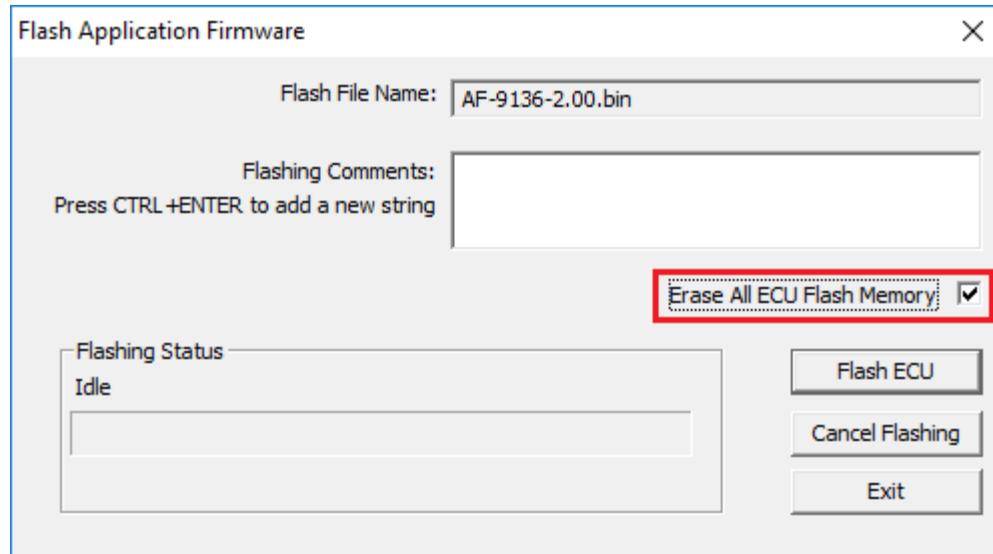
8. Confirm the warning message from the Axiomatic EA:
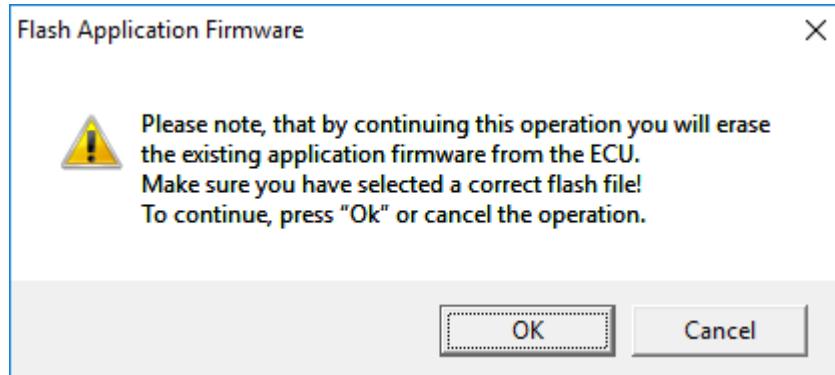
9. After confirming flashing, the user will see a progress bar showing the status of flashing operation on the Axiomatic EA screen:
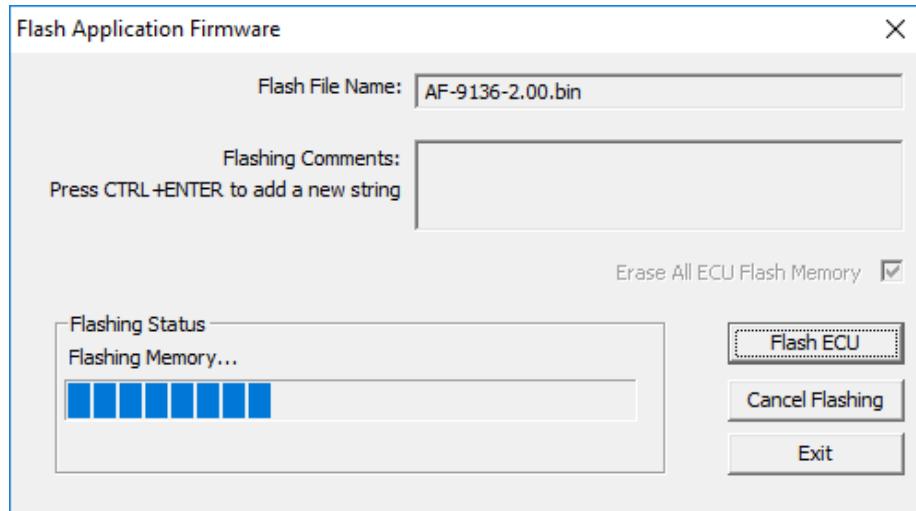
10. When flashing is done, reset the ECU.

After ECU is reset, the J1939 bootloader is no longer active, and the new CANopen® application firmware should be running.
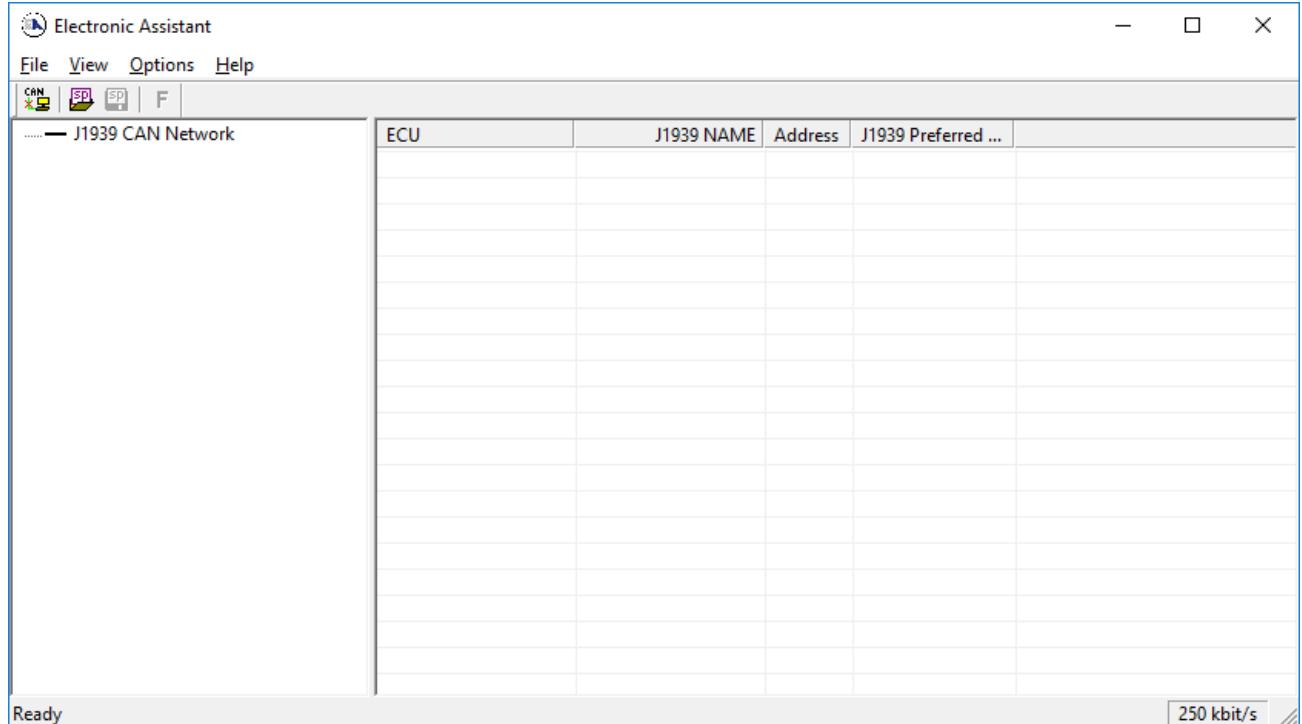
11. Cycle the power to the controller. Check the new application firmware (Object 1018h: Identity Object). In the CAN Assistant – Scope the user should see a single message from the new application firmware reporting that the unit is in the pre-operational state.

INSTALLATION INSTRUCTIONS

Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Protection	IP67, PCB is conformal coated and protected by the housing.
Packaging and Dimensions	High Temperature Nylon PCB Enclosure - (equivalent TE Deutsch P/N: EEC-325X4B) 4.62 x 5.24 x 1.43 inches 117.42 x 133.09 x 36.36 mm (W x L x H excluding mating plugs) Refer to housing dimensions drawing.
Mounting	Mounting holes sized for ¼ inch or M6 bolts. The bolt length will be determined by the end-user's mounting plate thickness. The mounting flange of the controller is 0.63 inches (16 mm) thick. If the module is mounted without an enclosure, it should be mounted vertically with connectors facing left and right to reduce likelihood of moisture entry. The CAN wiring is considered intrinsically safe. The power wires are not considered intrinsically safe and so in hazardous locations, they need to be located in conduit or conduit trays at all times. The module must be mounted in an enclosure in hazardous locations for this purpose. No wire or cable harness should exceed 30 meters in length. The power input wiring should be limited to 10 meters. All field wiring should be suitable for the operating temperature range. Install the unit with appropriate space available for servicing and for adequate wire harness access (6 inches or 15 cm) and strain relief (12 inches or 30 cm).
Network Termination	It is necessary to terminate the network with external termination resistors. The resistors are 120 Ohm, 0.25W minimum, metal film or similar type. They should be placed between CAN_H and CAN_L terminals at both ends of the network.

HOUSING DIMENSIONS

Housing Material: High Temperature Nylon (Black)
Protection Rating: IP67

3D VIEW
12 Pin Receptacle

4.677 [118.80]

Height 1.368 [34.75]
at 12 pin receptacle

5.237 [133.03]

EEC-325X4B

Deutsch IPD P/N
PCB Enclosure

Mounting Holes
ø 0.29 [7.40]
through 2 pl for
0.25 [6.00] fastener

Mounting flange:
16 mm [0.63 in] thick

4.00 [101.60]
Distance between mounting holes

BOTTOM VIEW

FRONT VIEW (NOT TO SCALE)
12 PIN RECEPTACLE

3.976 [101.00]

1.417 [36.00]

Key Arrangement A
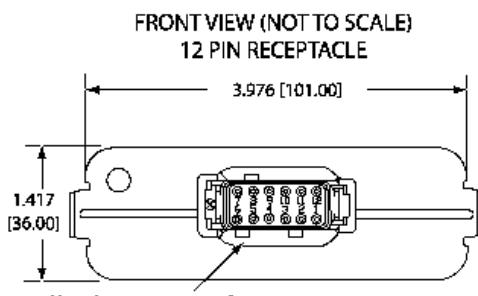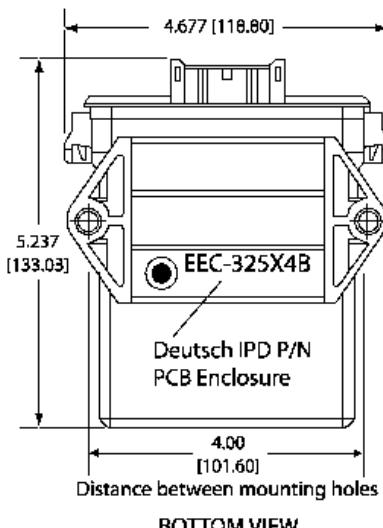
Mating Plug Assemblies:
12 pin receptacle - DTM06-12SA
 with wedgelock WM12S and contacts
24 pin receptacle - DTM06-12SA and DTM06-12SB
with wedgelocks WM12S and contacts
Contact factory for contact specification.

Dimensions: inches [mm]
excluding mating plug(s)

Electrical Connections	12-pin receptacle (equivalent TE Deutsch P/N: DTM13-12PA-R008) 20 AWG wire is recommended for use with contacts 0462-201-20141.	Mating plug KIT: Available from Axiomatic as p/n: **PL-DTM06-12SA**. It is equivalent to the following TE Deutsch P/Ns: plug (DTM06-12SA); wedgelock (WM12S); and 12 contacts (0462-201-20141) as well as 6 sealing plugs (0413-204-2005). *If not all of the outputs are required for the application, use the sealing plugs to fill the mating connector pins.* Wiring to these mating plugs must be in accordance with all applicable local codes. Suitable field wiring for the rated voltage and current must be used. The rating of the connecting cables must be at least 70°C. Use field wiring suitable for both minimum and maximum ambient temperature.

PIN #	FUNCTION
1	Analog GND
12	Analog GND
2	Output 1+
11	CAN_L
3	Output 2+
10	CAN_H
4	Output 3+
9	CAN_Shield
5	Output 4+
8	Power -
6	Analog GND
7	Power +

6 TECHNICAL SPECIFICATIONS

Input Specifications

Power Supply Input - Nominal	12V, 24V or 48VDC nominal (9…60 VDC power supply range)
Protection	Surge and reverse polarity protection are provided.
Isolation	A transformer power supply provides galvanic isolation between the power supply input and the analog signal outputs.
Input	CAN Messages, CANopen® The CAN signal can be filtered to accept messages from a single address on the network permitting a link to a specific ECU. A CANopen® tool is used to set up CAN signal acquisition and processing algorithms.

Output Specifications

CAN	The controller can send PDOs (CANopen®) to the network continuously or on request. Using a CANopen® tool, the user can configure this feature.
Analog Outputs	Up to 4 analog signal outputs are selectable by the user. Refer to Table 1.0.
Ground Connection	3 Analog GND connections are provided.
Protection for Output + Terminal	Fully protected against short circuit to ground and short circuit to power supply rail. Unit will fail safe in the case of a short circuit condition, self-recovering when the short is removed.

Table 1.0 – Outputs	
Analog Outputs	Up to 4 analog signal outputs are available. Using a CANopen® tool, the user selects: • the output mode (voltage or current); • and the minimum and maximum values for the output signal from the +/-10V or +/-20 mA range. Standard analog signal ranges are supported, including: 0-5V; 0-10V; +/-5V; +/-10V; 0-20mA; 4-20 mA; and +/-20mA. The outputs can be globally enabled or disabled.
Output Accuracy	0.5%
Output Resolution	0.015% (>12 bit)

General Specifications

Microprocessor	32-bit, 128 KByte flash program memory
Control Logic	Standard embedded software is provided. (Application-specific control logic or factory programmed setpoints are available on request.)
Monitoring and Troubleshooting	The controller can also transmit a CAN application message carrying signals internally generated by the controller. This feature can be used for monitoring and debugging purposes.
CAN	1 CAN port (CANopen®) The controller's object dictionary is compatible with the CiA DS-404 device profile (Device profile for measurement devices and closed-loop controllers). In addition to the standard objects for this device profile, the controller also includes a number of manufacturer specific objects to extend the functionality beyond that of the basic profile. The Axiomatic AX030501 is compliant with the following CAN in Automation (CiA) standards. <table><tr><td>[DS-301]</td><td>CiA DS-301 V4.02 – CANopen® Application Layer and Communication Profile. CAN in Automation 2002</td></tr><tr><td>[DS-404]</td><td>CiA DS-404 V1.2 – Device Profile for Measurement Devices and Closed-Loop Controllers. CAN in Automation 2002</td></tr><tr><td>[DS-305]</td><td>CiA DS-305 V2.0 – Layer Setting Service (LSS) and Protocols. CAN in Automation 2006</td></tr></table>
User Interface	Not supplied Any CANopen® service tool can be used to configure and monitor Axiomatic CANopen® controls.
Quiescent Current Draw	< 340 mA @ 12V and full load < 160 mA @ 24V and full load < 90 mA @ 48V and full load
Response Time	10 mSec. max.
Weight	0.50 lb. (0.23 kg)
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Storage Temperature	-55 to 125 °C (-67 to 257°F)
Vibration and Shock Compliance	MIL-STD-202G, Test 204D, 214A and 213B 7.68 Grms (Random) 10 g peak (Sine) 50 g (Shock)
Protection	IP67, PCB is conformal coated and protected by the housing.
Packaging and Dimensions	High Temperature Nylon PCB Enclosure - (equivalent TE Deutsch P/N: EEC-325X4B) 4.62 x 5.24 x 1.43 inches 117.42 x 133.09 x 36.36 mm (W x L x H excluding mating plugs) Refer to the housing dimensions drawing in Installation Instructions.

Note:

Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process as described on https://www.axiomatic.com/service/.

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OUR PRODUCTS

AC/DC Power Supplies

Actuator Controls/Interfaces

Automotive Ethernet Interfaces

Battery Chargers

CAN Controls, Routers, Repeaters

CAN/WiFi, CAN/Bluetooth, Routers

Current/Voltage/PWM Converters

DC/DC Power Converters

Engine Temperature Scanners

Ethernet/CAN Converters, Gateways, Switches

Fan Drive Controllers

Gateways, CAN/Modbus, RS-232

Gyroscopes, Inclinometers

Hydraulic Valve Controllers

Inclinometers, Triaxial

I/O Controls

LVDT Signal Converters

Machine Controls

Modbus, RS-422, RS-485 Controls

Motor Controls, Inverters

Power Supplies, DC/DC, AC/DC

PWM Signal Converters/Isolators

Resolver Signal Conditioners

Service Tools

Signal Conditioners, Converters

Strain Gauge CAN Controls

Surge Suppressors

OUR COMPANY

Axiomatic provides electronic machine control components to the off-highway, commercial vehicle, electric vehicle, power generator set, material handling, renewable energy and industrial OEM markets. *We innovate with engineered and off-the-shelf machine controls that add value for our customers.*

QUALITY DESIGN AND MANUFACTURING
We have an ISO9001:2015 registered design/manufacturing facility in Canada.

WARRANTY, APPLICATION APPROVALS/LIMITATIONS
Axiomatic Technologies Corporation reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process at https://www.axiomatic.com/service/.

COMPLIANCE
Product compliance details can be found in the product literature and/or on axiomatic.com. Any inquiries should be sent to sales@axiomatic.com.

SAFE USE
All products should be serviced by Axiomatic. Do not open the product and perform the service yourself.

SERVICE
All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#) from sales@axiomatic.com. Please provide the following information when requesting an RMA number:
- Serial number, part number
- Runtime hours, description of problem
- Wiring set up diagram, application and other comments as needed

DISPOSAL
Axiomatic products are electronic waste. Please follow your local environmental waste and recycling laws, regulations and policies for safe disposal or recycling of electronic waste.

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