Single Channel CAN Controller Universal Input, 2A Output

with CANopen®

USER MANUAL

P/N: AX021602

In Europe:
Axiomatic Technologies Oy
Hepolamminkatu 36 C 3
33720 TAMPERE - Finland
Tel. +358 3 3595 600
Fax. +358 3 3595 660
www.axiomatic.fi

In North America:
Axiomatic Technologies Corporation
5915 Wallace Street
Mississauga, ON Canada L4Z 1Z8
Tel. 1 905 602 9270
Fax. 1 905 602 9279
www.axiomatic.com

VERSION HISTORY

User Manual Version	Firmware version	Date	Author	Modifications
1.00	1.xx	Apr. 21, 2009	Antti Keränen	Initial release, based on the UMAX021600 manual.
1.01	1.03	Oct.02 2009	Antti Keränen	Fixed some errors and added objects 0x6000, 0x6001, 0x6311 and 0x6312
1.02	1.03	Oct.06 2009	Antti Keränen	Added block diagrams for analog and digital outputs and inputs
1.03	1.04	Oct.09 2009	Antti Keränen	Cleaned up some notes
1.04	1.05	Oct.13 2009	Antti Keränen	Added installation instructions, removed firmware flashing notes. Marketing comments added. Added figures for AO and AI PVs and FVs.
1.05	1.06	Oct.15 2009	Antti Keränen	Tables 1 and 3, units fixed. PDO parameters updated. More detailed description for analog and digital inputs.
1.06	1.08	Oct.19 2009	Antti Keränen	Added object 3310h, updated figures 2&5 and modified object 6310h and table 3 to include new output types. Objects 7120h, 7121h, 7122h, 7123h and 7124h changed to U32.
1.07	1.11	May.31, 2010	Antti Keränen	Objects 0x2030 and 0x2031 descriptions updated
1.08	1.11	Jun. 8, 2010	Antti Keränen	Several small fixes to various objects' descriptions. Missing object descriptions added.
1.09	1.12	Jun. 9, 2010	Antti Keränen	Several fixes to various objects' value ranges.
1.10	1.13	Jun. 14, 2010	Antti Keränen	Objects' data types (2202h,2203h,2302h,2303h,7100h,7120h-7124h,7130h) updated, time field added to object 1020h description.
1.11	1.18	Jul. 2, 2010	Antti Keränen	Hotshot functionality description updated
2.0.0	1.18.2	Feb 17, 2011	Anna Murray	Formatting updated to match Axiomatic template. Added new object 5555h
2.0.1	1.22.107	Nov 22, 2011	Antti Keränen	RX PDO mappings changed, object 7300h made writable

ACRONYMS

CAN	Controller Area Network
CANopen	CAN-based higher layer protocol supported by CAN in Automation (CiA)
ECU	Electronic control unit
PC	Personal Computer
PID	Proportional–integral–derivative (regulator)
PWM	Pulse–width modulation
RS232	PC serial port interface
USB	Universal Serial Bus.
UTP	Un-shielded twisted pair

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1 INTRODUCTION

The following User Manual describes functionality, setup procedures of the Single Channel CAN Controller, Universal Input, 2A Output. The manual does not include detailed technical characteristics and connector pinouts of the controller. For this information, please refer to the technical datasheet of the product.

The controller is designed to control a solenoid valve using a variety of input sources. It accepts: voltage, current, resistance, frequency, PWM, and discrete levels. On top of this, due to the presence of the CAN interface, the valve can be directly driven by signals transmitted on the CAN bus. It can also provide a feedback on the CAN bus transmitting the controller internal parameter values.

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.

Due to high versatility of the controller, it can be used, with some minor restrictions, to control noninductive loads, for example: automotive lamps. Without a load, it can also be used as a physical signal to CAN convertor, converting: voltage, current, etc. into CAN messages.

2 CONTROLLER ARCHITECTURE

The controller architecture consists of a several independent functional blocks, which can be logically connected together forming the required control structure, Fig. 1.

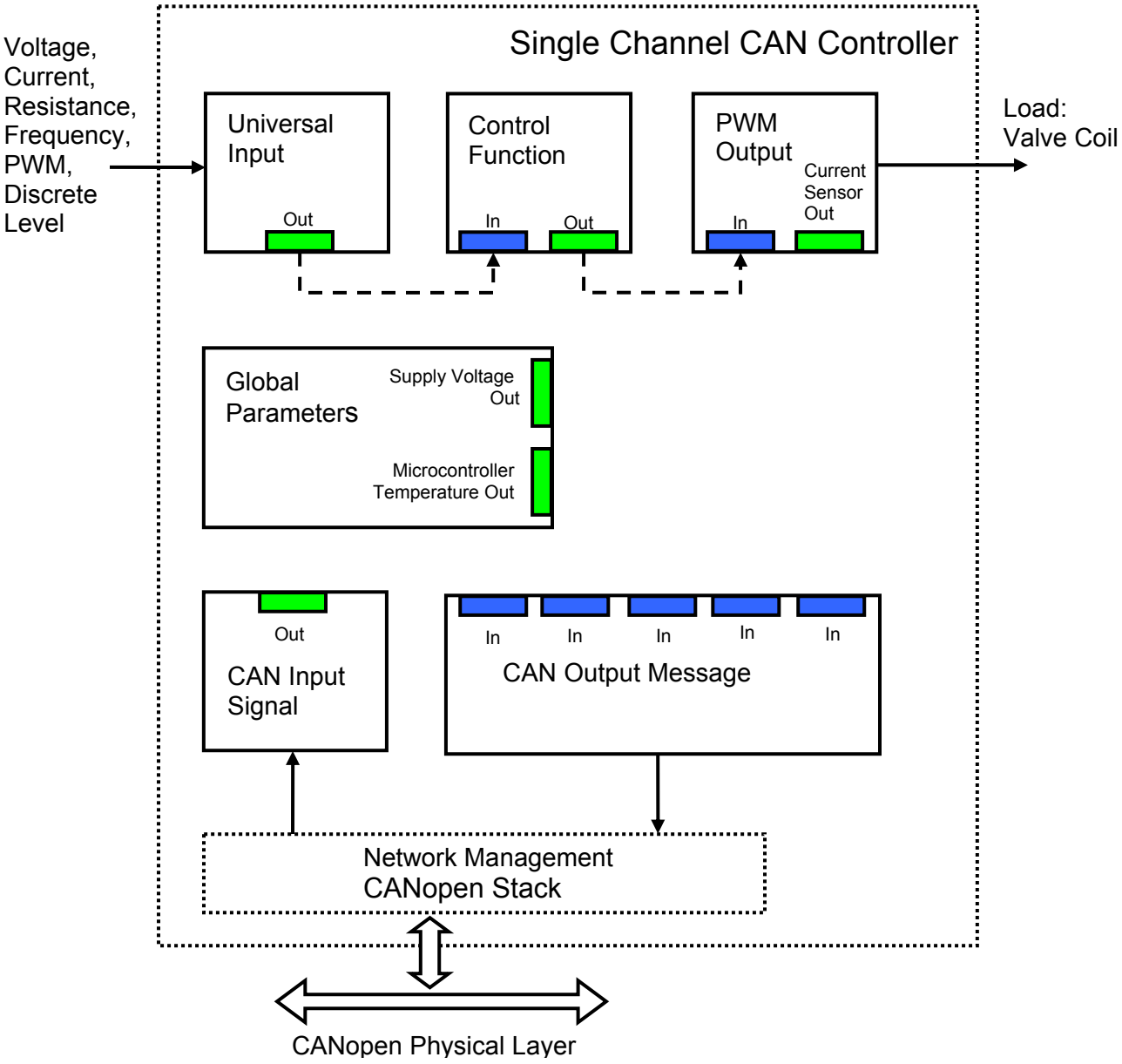


Figure 1: Controller Architecture. As an example, Universal Input is connected to the Control Function and the Control Function to the PWM Output, providing a path for the signal from input to output through the Control Function. CAN input and outputs are not used.

There are two types of functional blocks presented in the controller: hardware–dependent and hardware–independent. The first one includes: Universal Input, PWM Output and Global Parameters. The number of the hardware–dependent functional blocks is fixed; they present and are closely bound to the underlined hardware. The number of the hardware–independent functional blocks, on the other hand, is potentially limited only by the microcontroller system resources, such as: memory size, speed, etc, and can be easily increased in the future versions of

the controller. To the hardware–independent functional blocks belong: Control Function, CAN Input Signal, CAN Output Message

By setting up logical data connections between logical inputs and logical outputs of the functional blocks, the user can build virtually any type of a custom control. This architecture, based on this open approach to the unit configuration gives the user an absolute freedom of customization and an ability to fully utilize the controller hardware resources in the user's applications.

Depending on the block functionality, a functional block can have a logical input, logical output or a combination of logical inputs and logical outputs.

The logical input object defines the connection between a logical input and a logical output in the controller. The following rules apply:

- A logical input can be connected to any logical output using the 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 a signal source by logical inputs.

To provide data flow between logical inputs and outputs, all logical outputs 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 then restored, if necessary, at the logical inputs using the following reverse transformation:

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

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

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

The functional blocks of the controller are described bellow.

2.1 Universal Input

The Universal Input functional block controls data acquisition of the universal input hardware of the controller. It defines a type of the electrical input parameter, its range, filtering requirements, and sets up parameters for the input signal normalization. The Universal Input functional block has one logical output providing a normalized input signal to other functional blocks of the controller.

Universal Input block can be divided into Analog Input and Digital Input subsystems, described below.

2.1.1 Analog Input

Analog input block and related CANopen objects are shown in Figure 2. Note, that changing input ranges (voltage, current or frequency) will **automatically** set the corresponding minimum and maximum values. If a custom minimum and/or maximum value for any input range is needed, the range needs to be set first (2100h, 2110h, 2120h).

> Before changing any of the objects 2200h, 2201h, 2202h, 2203h, 2204h, 2300h, 2301h, 2302h, 2303h, 2304h, the range needs to be specified using objects 2100h, 2110h and/or 2120h. Changing the value of 2100h, 2110h or 2120h will **AUTOMATICALLY set the corresponding DEFAULT** minimum and maximum value!

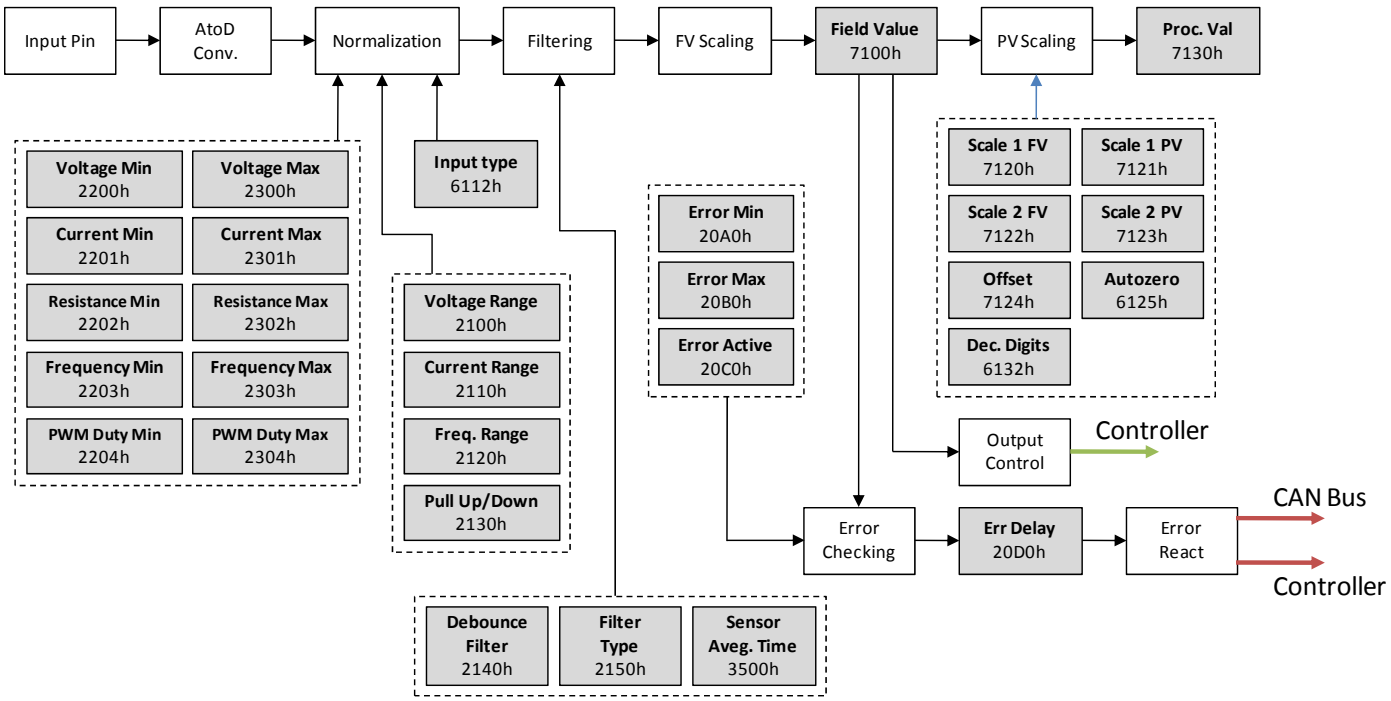


Figure 2: Analog Input block diagram

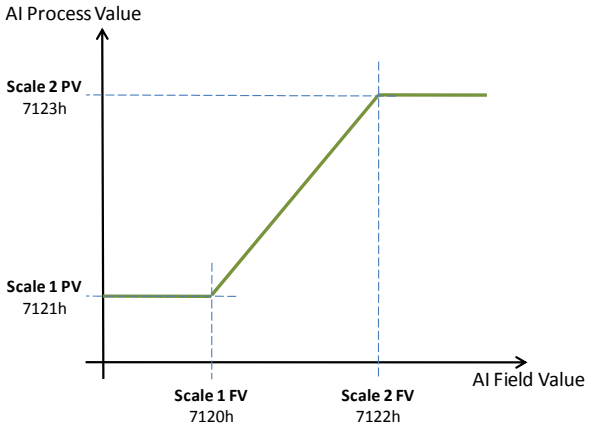


Figure 3: AI Field value vs. AI Process value

2.1.2 Digital Input

Digital input block and related CANopen objects are shown in Figure 4. If the input is configured as voltage input, the thresholds for low and high values can be set using 2030h and 2031h. If the input is configured as discrete, the low/high transition is based on the internal logic of the controller. The digital input state is shown also in objects 7100h and 7130h (field value and process value, respectively), value is scaled using FV and PV scaling coefficients (7120h, 7121h, 7122h, 7123h).

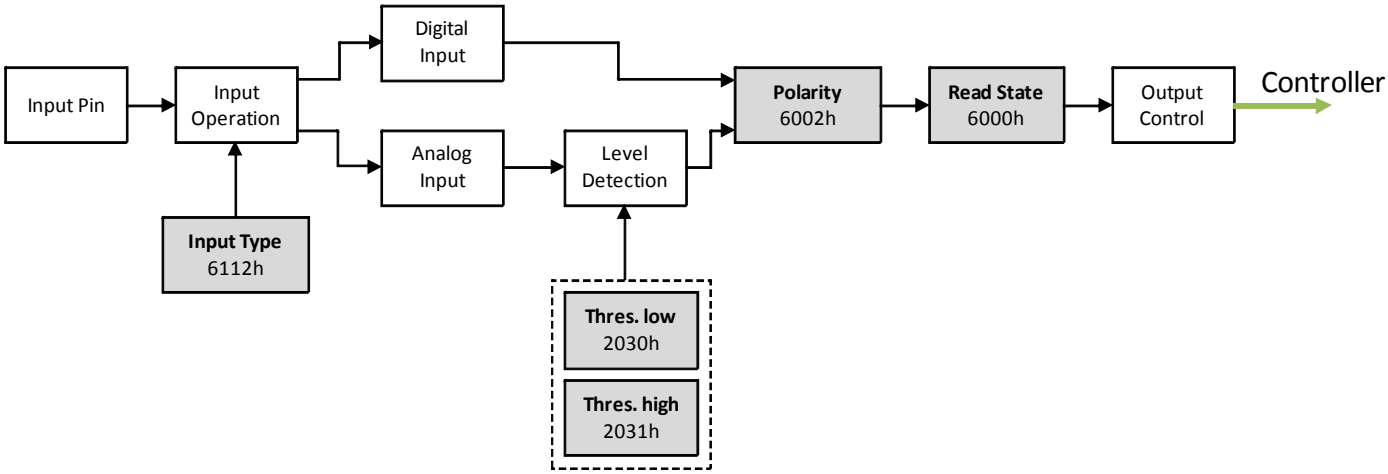


Figure 4: Digital Input block diagram

This functional block has the following set of objects:

Table 1: Input block (both analog and digital) parameters

Name	Default Value	Range	Units	Description
Input Type	Voltage	{Input Disabled, Voltage, Current, Resistance, Discrete Voltage Level, Frequency, PWM Duty Cycle}	–	Specifies the type of the universal input.
Voltage Range	0…5V	{0…10V, 0…5V, 0…2.5V, 0…1V}	–	Voltage range of the voltage measuring input circuit.

Name	Default Value	Range	Units	Description
Current Range	0…20mA	{0…20mA, 4…20mA}	–	Current range of the current measuring input cuircuit.
Frequency Range	10Hz…1kHz	{10Hz…1kHz, 100Hz…10kHz}	–	Frequency range of the frequency and PWM measuring input circuit.
Pull-Up/Pull-Down Resistor	10kOhm Pull-Down	{Disabled, 10kOhm Pull-Up, 10kOhm Pull-Down}	–	Specifies a pull-up/pull-down resistor when measuring: discrete voltage level, frequency or PWM duty cycle.
Analog Input Filter	Both: 50Hz and 60Hz noise rejection	{Disabled, 50Hz noise rejection, 60Hz noise rejection, Both: 50Hz and 60Hz noise rejection}	–	Filters out industrial noise for voltage, current and resistance measurements.
Debounce Input Filter	1.78µs	{Disabled, 111ns, 1.78µs, 14.22µs}	–	Debounce input digital filter for measuring frequency and PWM duty cycle.
Digital Input Polarity	Active High	{Active High, Active Low}	–	Input polarity for discrete voltage level and PWM duty cycle measurements.
Vmax – Maximum Input Voltage	5000	[0…10], but Vmax>Vmin	mV	Normalization parameter for measuring voltage.
Vmin – Minimum Input Voltage	0	[0…10], but Vmin<Vmax	mV	Normalization parameter for measuring voltage.
Imax – Maximum Input Current	20000	[0…20], but Imax>Imin	µA	Normalization parameter for measuring current.
Imin – Minimum Input Current	0	[0…20], but Imin<Imax	µA	Normalization parameter for measuring current.
Rmax – Maximum Input Resistance	300000	[0.01…300], but Rmax>Rmin	Ohm	Normalization parameter for measuring resistance.
Rmin – Minimum Input Resistance	10	[0.01…300], but Rmin<Rmax	Ohm	Normalization parameter for measuring resistance.
Fmax – Maximum Input Frequency	1000	[10…10000], but Fmax>Fmin	Hz	Normalization parameter for measuring frequency.
Fmin – Minimum Input Frequency	10	[10…10000], but Fmin<Fmax	Hz	Normalization parameter for measuring frequency.
Dmax – Maximum Duty Cycle	100	[0…100], but Dmax>Dmin	%	Normalization parameter for measuring PWM duty cycle.
Dmin – Minimum Duty Cycle	0	[0…100], but Dmin<Dmax	%	Normalization parameter for measuring PWM duty cycle.

2.2 Control Function

The Control Function functional block allows users to specify their own control profile or to perform linearization of an input sensor.

It has one logical input and one output, and implements a function:

$$Yn = F(Xn),$$

where: Xn – normalized input parameter,
Yn – normalized output parameter.

The function is defined using a piecewise linear approximation in up to 11 points. Each point is presented by three parameters:

$$P_i = (State_i, Xn_i, Yn_i),\ i = 0\ldots 10,$$

where: P_i – i-th point of the function F,
$State_i$ – state of the i-th point. Can be: {Off, On},
Xn_i – normalized input value at the i-th point.
Yn_i – normalized output value at the i-th point.
If the State of the point is Off, it is not active and is not used for the function approximation.

The function values between active points are defined the following way:

$$Yn = A_j \bullet Xn + B_j\ ,\ j = 0\ldots N,\ N \leq 10,$$

$$A_j = (Yn_j - Yn_{(j+1)}) / (Xn_j - Xn_{(j+1)})\ ,$$

$$B_j = (Yn_{(j+1)} \bullet Xn_j - Yn_j \bullet Xn_{(j+1)}) /\ (Xn_j - Xn_{(j+1)})\ ,$$

$$Xn \in [Xn_j\ ;\ Xn_{(j+1)}[$$

where: A_j, B_j – linear approximation coefficients between j and (j+1) active points.
N – number of active, with $State_i$=On, points,

The control function is also capable to implement a hotshot control. For this purpose the user can specify two values for the last, 10-th, function point. The first value is a regular one and the second value comes into effect after a hotshot delay. Hotshot functionality is controlled with objects 3000h and 3001h.

The Control Function logical block has the following set of objects:

Table 2: Control Function parameters

Name	Default Value	Range	Units	Description
Signal Source	Universal Input	{Not Connected, Universal Input, PWM Output Current Sensor, CAN Input, Supply Voltage, Microcontroller Temperature}	–	Defines a source of Xn. It can be any logical output of any logical block[1]
Point 0 State	On	–	–	$State_0$. Read only parameter.
Point 0 X	0	–	–	Xn_0. Read only parameter.
Point 0 Y	0	[0;1]	–	Yn_0
Point 1 State	Off	{Off, On}	–	$State_1$
Point 1 X	0.1	$[Xn_0; Xn_2]$	–	Xn_1
Point 1 Y	0	[0;1]	–	Yn_1
Point 2 State	Off	{Off, On}	–	$State_2$
Point 2 X	0.2	$[Xn_1; Xn_3]$	–	Xn_2
Point 2 Y	0	[0;1]	–	Yn_2

Name	Default Value	Range	Units	Description
Point 3 State	Off	{Off, On}	–	$State_3$
Point 3 X	0.3	[Xn_2; Xn_4]	–	Xn_3
Point 3 Y	0	[0;1]	–	Yn_3
Point 4 State	Off	{Off, On}	–	$State_4$
Point 4 X	0.4	[Xn_3; Xn_5]	–	Xn_4
Point 4 Y	0	[0;1]	–	Yn_4
Point 5 State	Off	{Off, On}	–	$State_5$
Point 5 X	0.5	[Xn_4; Xn_6]	–	Xn_5
Point 5 Y	0	[0;1]	–	Yn_5
Point 6 State	Off	{Off, On}	–	$State_6$
Point 6 X	0.6	[Xn_5; Xn_7]	–	Xn_6
Point 6 Y	0	[0;1]	–	Yn_6
Point 7 State	Off	{Off, On}	–	$State_7$
Point 7 X	0.7	[Xn_6; Xn_8]	–	Xn_7
Point 7 Y	0	[0;1]	–	Yn_7
Point 8 State	Off	{Off, On}	–	$State_8$
Point 8 X	0.8	[Xn_7; Xn_9]	–	Xn_8
Point 8 Y	0	[0;1]	–	Yn_8
Point 9 State	Off	{Off, On}	–	$State_9$
Point 9 X	0.9	[Xn_8; Xn_{10}]	–	Xn_9
Point 9 Y	0	[0;1]	–	Yn_9
Point 10 State	On	–	–	$State_{10}$. Read only parameter.
Point 10 X	1	–	–	Xn_{10}. Read only parameter.
Point 10 Y	0	[0;1]	–	Yn_{10}
Hotshot Delay	0	–	ms	Undefined if 0
Hotshot Y	0	[0;1]	–	Yn_{10}, if Time>Hotshot Delay, and Hotshot Delay $\neq$ 0.

[1]Logical output of the Control Function block itself is excluded for convenience.

2.3 PWM Output

The PWM Output functional block presents the PWM hardware output stage of the controller. It has one logical input to control the load and a logical output providing information from the current sensor connected to the load.

The user can select: the output mode, minimum and maximum output values, dither parameters, ramps, and PID coefficients to control the output load. For the current sensor, the user can define an averaging time to minimize effect of the output dither on the current sensor readings.

PWM output block can be divided into Analog Output and Digital Output subsystems, described below.

2.3.1 Analog Output

Analog output and related CANopen objects are shown in Figure 5. The field value (7330h) minimum and maximum value will be determined by objects 7320h, 7321h, 7322h and 7323h, see Figure 6.

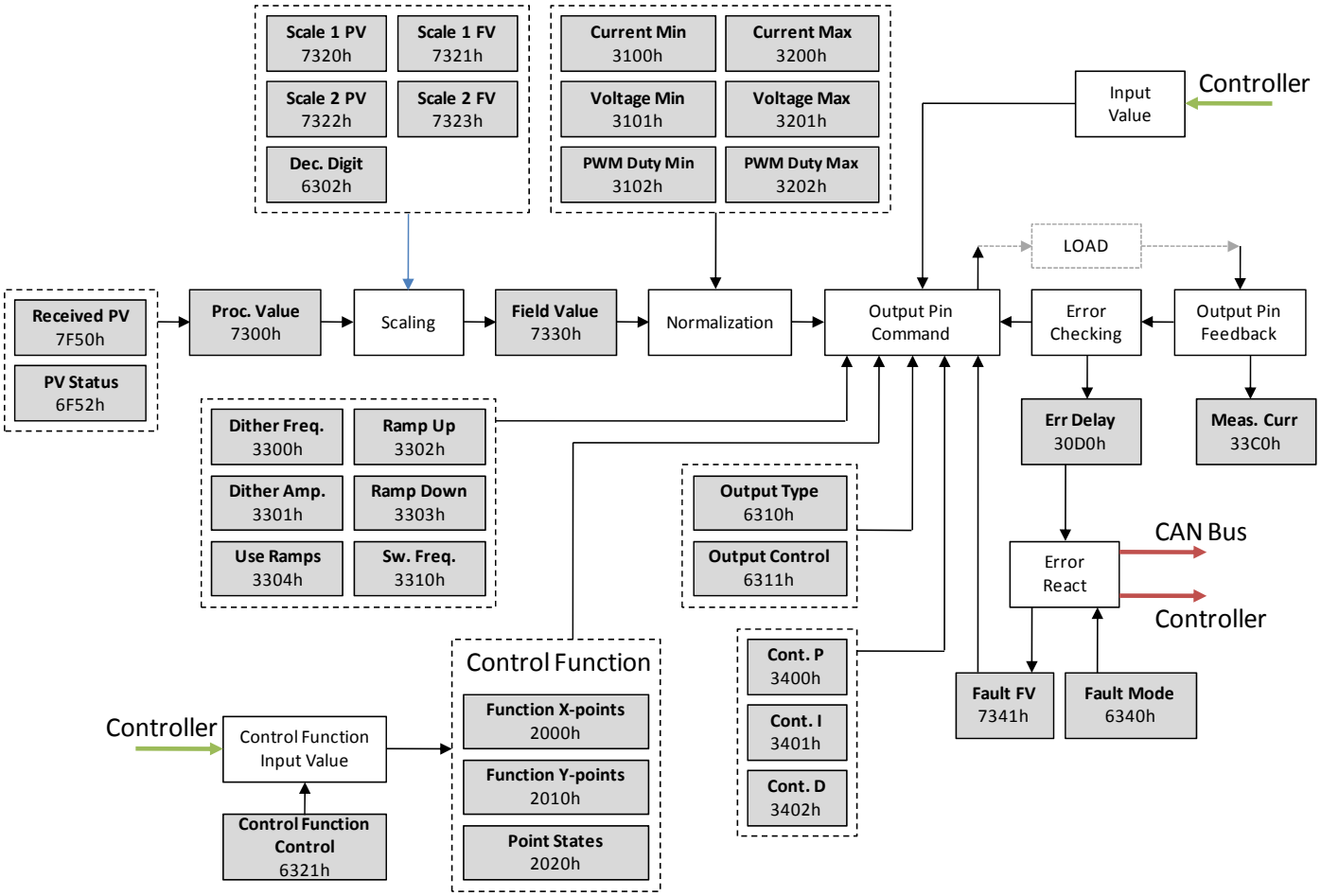


Figure 5: Analog output block diagram

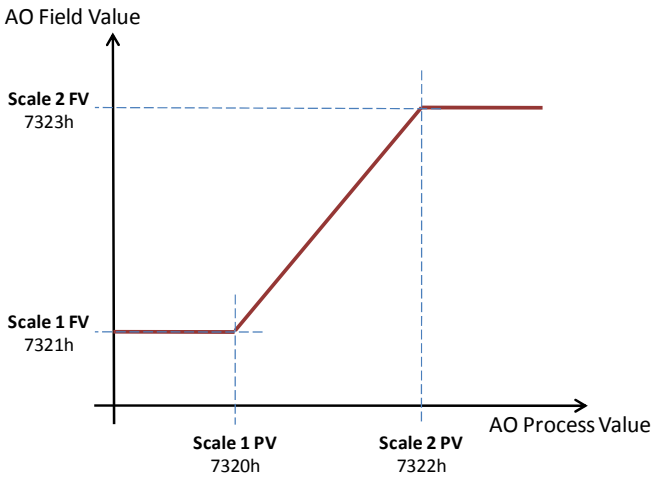


Figure 6: AO Process value vs. AO Field value

2.3.2 Digital Output

Digital Output and related CANopen objects are shown in Figure 7

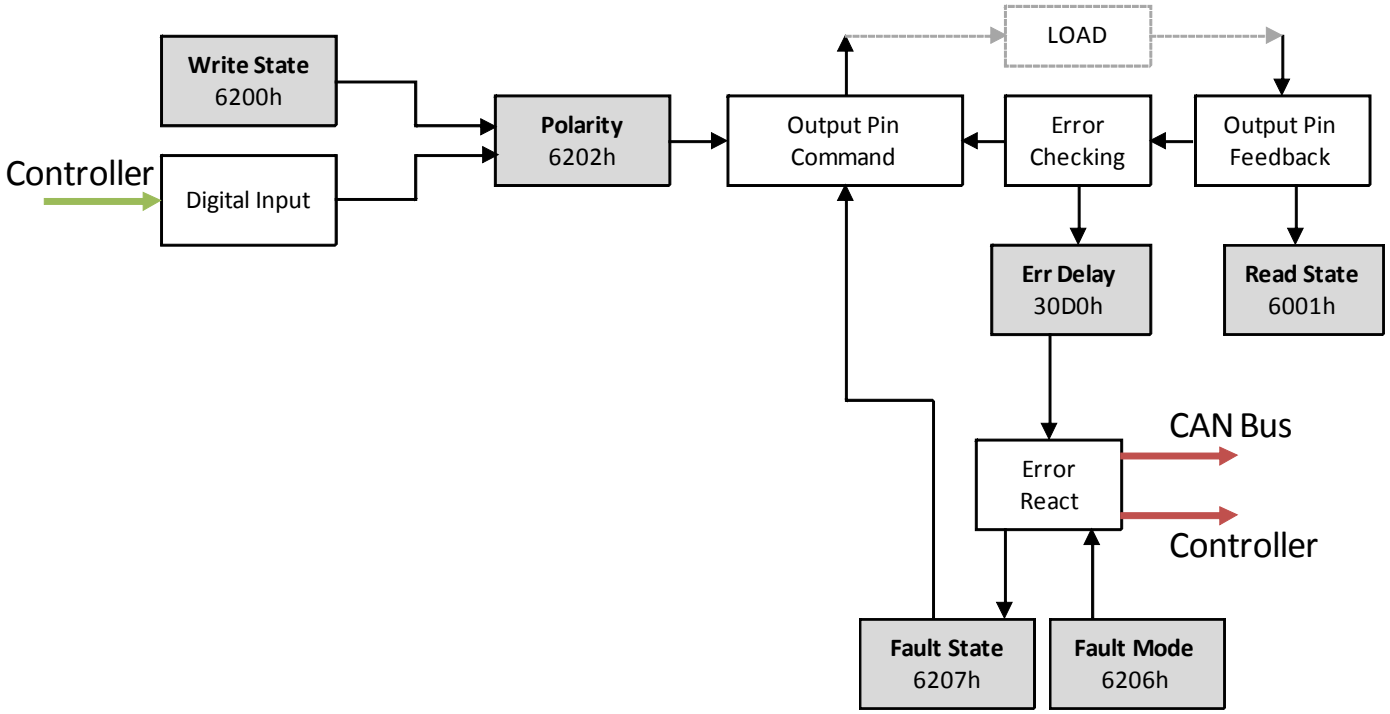


Figure 7: Digital output block diagram

The PWM Output logical block has the following set of objects:

Table 3: Output block (both analog and digital) parameters

Name	Default Value	Range	Units	Description
Output Mode	Output Current	{Output Disable, Discrete On/Off, Output Current, Output Voltage, Output PWM Duty Cycle, Sw. Current, Sw. Voltage}	–	Specifies the type of the load control
Signal Source	Universal Input	{Not Connected, Universal Input, Control Function, CAN Input, Supply Voltage, Microcontroller Temperature}	–	Defines the source of the control signal. It can be a logical output of any logical block[1].
Imax – Max Output Current	20000	[0; 2], but Imax>Imin	µA	Normalization parameter for Output Current mode. Limited, if DithAmp is high[2].
Imin – Min Output Current	0	[0;2], but Imin<Imax	µA	Normalization parameter for Output Current mode.
Vmax – Max Output Voltage	12000	[0; 24], but Vmax>Vmin	mV	Normalization parameter for Output Voltage mode.
Vmin – Min Output	0	[0; 24], but Vmin<Vmax	mV	Normalization parameter for

Name	Default Value	Range	Units	Description
Voltage				Output Voltage mode.
Dmax – Max PWM Duty Cycle	100	[0; 100], but Dmax<Dmin	%	Normalization parameter for Output PWM Duty Cycle mode.
Dmin – Min PWM Duty Cycle	0	[0; 100], but Dmin<Dmax	%	Normalization parameter for Output PWM Duty Cycle mode.
RampUp – Ramp Up Time	0	[0; 100000]	ms	Time, during which the output ramps from Min to Max value
RampDown – Ramp Down Time	0	[0; 100000]	ms	Time, during which the output ramps from Max to Min value
DithFreq – Dither Frequency	100	[20; 400]	Hz	Frequency of the superimposed Dither
DithAmp – Dither Amplitude	10	[0; 40]	%	Defined in % of Max value. Limited, if Imax is high[2].
PID parameter Kp	1500	[0; 1000000]	–	Proportional Gain. Password Protected[3].
PID parameter Ki	10	[0; 1000000]	–	Integral Gain. Password Protected[3].
PID parameter Kd	0	[0; 1000000]	–	Derivative Gain. Password Protected[3].
Current Sensor Averaging Time	50	[0; 1000]	ms	Current Sensor readings will be updated every specified averaging period of time with the average value calculated on the previous averaging time interval.
Output On/Off Switching Speed	0	[0; 50]	Hz	Sw. Voltage and Sw. Current output on/off switching speed.

[1]Output of the PWM Output block itself is excluded for convenience.
[2]Due to a limited dynamic range of the current control circuit, Imax and DithAmp values should satisfy the following equation:

$$Imax \cdot (1 + DithAmp/100) \leq 2.2 ,$$

where: 2.2 – internal control constant.
[3]To avoid accidental changing of the PID regulator parameters, they are password protected. The password is: PIDSetupNow, case sensitive.

2.4 Global Parameters

The Global Parameters logical function block has two logical outputs, which provide access to the controller supply voltage and the microcontroller embedded temperature sensor.

The logical block objects are presented in the following table:

Table 4: Global parameters

Name	Default Value	Range	Units	Description

Name	Default Value	Range	Units	Description
Vsmax – Max Supply Voltage	70	–	V	Normalization parameter for the controller supply voltage. Read only parameter.
Vsmin – Min Supply Voltage	0	–	V	Normalization parameter for the controller supply voltage. Read only parameter.
Tmax – Max Microcontroller Temperature	150	–	°C	Normalization parameter for the microcontroller embedded temperature sensor. Read only parameter.
Tmin – Min Microcontroller Temperature	-50	–	°C	Normalization parameter for the microcontroller embedded temperature sensor. Read only parameter.

2.5 Slew Rate Control

To adjust the controller CAN output to the parameters of the physical network, the controller has an object (0x102A) for controlling the CAN transceiver slew rate. It can be set to fast or slow values according to the following table:

Table 5: Slew rate settings

Object Value	Slew Rate
Fast (1)	19 V/µs
Slow (0 – default)	4 V/ µs

For the majority of CANopen applications the slow value of the object is preferable due to the reduced EMI of the transceiver.

2.6 Network Bus Terminating Resistors

The controller does not have an embedded 120Ohm CAN bus terminating resistor. The appropriate resistors should be installed externally on both ends of the CAN twisted pair cable according to the standards.

Even if the length of the CAN network is short and the signal reflection from both ends of the cable can be ignored, at least one 120Ohm resistor is required for the majority of CAN transceivers to operate properly.

3 CONTROLLER ARCHITECTURE

The CANopen object dictionary of the Single Channel CAN Controller is based on CiA device profile DS-404 V1.2. (Device profile for measurement devices and closed-loop controllers.) The object dictionary also includes some manufacturer-specific objects for extended functionality.

3.1 COMMUNICATION OBJECTS

The communication objects supported by the Single 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-301.

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
5555	Start in Operational Mode	VAR	BOOLEAN	RW	No

3.1.1 PDO Parameters

All RPDOs and TPDOs in the Single 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 4 subindexes 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	0	Number of mapped application objects in PDO
1	0x62000108	Write State 1 Output Line
2	0	
3	0	
4	0	

RPDO2: default ID 0x300 + node ID

Subindex	***Value***	***Object***
0	1	Number of mapped application objects in PDO
1	0x73000110	Process value
2	0	
3	0	
4	0	

RPDO3: default ID 0x400 + node ID

Subindex	***Value***	***Object***
0	0	Number of mapped application objects in PDO
1	0x7F500110	Received PV 1 Output
2	0	
3	0	
4	0	

RPDO4: default ID 0x500 + node ID

Subindex	***Value***	***Object***
0	0	Number of mapped application objects in PDO
1	0x6F520108	Received PV Status 1 Output
2	0	
3	0	
4	0	

TPDO1: default ID 0x180 + node ID

Subindex	*Value*	*Object*
0	0	Number of mapped application objects in PDO
1	0x60000108	Read State 1 Output Line
2	0	
3	0	
4	0	

TPDO2: default ID 0x280 + node ID

Subindex	*Value*	*Object*
0	1	Number of mapped application objects in PDO
1	0x33C00110	Measured Current for OUT1
2	0	
3	0	
4	0	

TPDO3: default ID 0x380 + node ID

Subindex	*Value*	*Object*
0	1	Number of mapped application objects in PDO
1	0x71000120	Input field value of IN1
2	0	
3	0	
4	0	

TPDO4: default ID 0x480 + node ID

Subindex	*Value*	*Object*
0	0	Number of mapped application objects in PDO
1	0	
2	0	
3	0	
4	0	

3.1.2 Object 1000h: Device Type

This object contains information about the device type as per device profile DS-404. The value stored in this object is 0x000F0194, indicating that the Single Channel CAN Controller includes the following function blocks defined in the device profile.

- Digital Output (DO)
- Analog Output (AO)
- Digital Input (DI)
- Analog Input (AI)

Object Description

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

Entry Description

Access	RO
PDO Mapping	No
Value Range	0x000F0194
Default Value	0x000F0194

3.1.3 Object 1001h: Error Register

This object is an error register for the device. Any time there is an error detected by the Single Channel 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

3.1.4 Object 1002h: Manufacturer Status Register

This object is used for manufacturer debug purposes.

3.1.5 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 Single Channel CAN Controller has a limitation of a maximum of 16 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.

MSB			**LSB**
Error Description	Channel	EMCY Error Code	

See Section 4 for a complete list of the error code fields.

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

3.1.6 Object 100Bh: Node-ID

This object contains the CANopen node-ID of the Single Channel 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

3.1.7 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

3.1.8 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

3.1.9 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 Single Channel 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 Single Channel 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)

3.1.10 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 Single Channel 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 Single Channel 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)

3.1.11 Object 1016h: Consumer Heartbeat Time

The Single Channel 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 Single Channel 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

3.1.12 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

3.1.13 Object 1018h: Identity Object

The identity object indicates the data of the Single Channel 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	0xAA021601
Default Value	0xAA021601

Subindex	3h
Description	Revision Number
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	00010218

Subindex	4h
Description	Serial Number
Access	RO

PDO Mapping	No
Value Range	UNSIGNED32
Default Value	No

3.1.14 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 0x08062010 would indicate that the software was compiled on June 8th, 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

3.1.15 Object 1029h: Error Behavior

This object controls the state that the Single Channel CAN Controller will be set into in case of an error of the type associated with the subindex. The behavior of the Single Channel CAN Controller in each state is described in detail in section 4.

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)

3.1.16 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
Default Value	0 – slow, 1 – fast (see Table 5)

3.1.17 Object 5555h: Start in Operational Mode

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]

3.2 DIGITAL OUTPUT FUNCTION BLOCK (DS-404)

The application and manufacturer objects supported by the Single Channel CAN Controller for the digital output block are listed in the following table.

Index (hex)	*Object*	*Object Type*	*Data Type*	*Access*	*PDO Mapping*
6001	DO Read State 1 Output Line	ARRAY	UNSIGNED8	RO	Yes
6200	DO Write State 1 Output Line	ARRAY	UNSIGNED8	RW	Yes
6202	DO Polarity 1 Output Line	ARRAY	UNSIGNED8	RW	No
6206	DO Fault Mode 1 Output Lines	ARRAY	UNSIGNED8	RW	No
6207	DO Fault State 1 Output Lines	ARRAY	UNSIGNED8	RW	No

3.2.1 Object 6001h: DO Read State Output Line

This object is used for reading the state of digital output line (in 8-bit block). Note, that this object shows the status only when the digital output block is controlled over CAN.

Object Description

Index	6001h
Name	DO Read State Output Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Digital output state
Access	RO
PDO Mapping	Yes
Value Range	0, 1

3.2.2 Object 6200h: DO Write State 1 Output Line

This object is used for writing the state of digital output line (in 8-bit block). For proportional outputs that are not configured as digital, the corresponding bit in the byte is ignored.

Object Description

Index	6200h
Name	DO Write State 1 Output Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO

PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Write State, all Digital Outputs
Access	RW
PDO Mapping	Yes
Value Range	Bit Value 0 = Set DO off Bit Value 1 = Set DO on
Default Value	0h

3.2.3 Object 6202h: DO Polarity 1 Output Line

This object is used for setting the polarity of digital output line (in 8-bit block). For proportional outputs that are not configured as digital, the corresponding bit is ignored. When the bit is set, inverse polarity is active, such that the control input being ON will set the output OFF, and vice versa. Note, that this object has control over digital output only when the digital output block is controlled over CAN.

Object Description

Index	6202h
Name	DO Polarity 1 Output Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Polarity, all Digital Outputs
Access	RW
PDO Mapping	No
Value Range	Bit Value 0 = Normal polarity Bit Value 1 = Inverse polarity
Default Value	0h (all normal polarity)

3.2.4 Object 6206h: DO Fault Mode 1 Output Line

This object defines the fault mode response for digital output (in 8-bit block). For proportional outputs that are not configured as digital, the corresponding bit is ignored. It determines whether the output shall continue to operate normally when the Single Channel CAN Controller detects an error, or if the output shall be driven to the state defined in object 6207h. For more details about the Single Channel CAN Controller error response, see section 5.

- Bit value 0 = output continues to operate normally in controller fault state
- Bit value 1 = take action defined in object 6207h in controller fault state

Object Description

Index	6206h
Name	DO Fault Mode 1 Output Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Fault Mode, all Digital Outputs
Access	RW
PDO Mapping	No
Value Range	Bit Value 0 = Continue normally Bit Value 1 = Take action
Default Value	0x00h (all as per object 6207h)

3.2.5 Object 6207h: DO Fault State 1 Output Line

This object defines the state that digital outputs will be driven to in fault situations in (8-bit block). For proportional outputs that are not configured as digital, the corresponding bit is ignored.

- Bit value 0 = drive output off in controller fault state
- Bit value 1 = drive output on in controller fault state

Object Description

Index	6207h
Name	DO Fault State 1 Output Lines
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Fault State, all Digital Outputs
Access	RW
PDO Mapping	No
Value Range	Bit Value 0 = Drive output off Bit Value 1 = Drive output on
Default Value	0000h (all off in fault mode)

3.3 DIGITAL INPUT FUNCTION BLOCK (DS-404)

The application and manufacturer objects supported by the Single Channel CAN Controller for the digital input block are listed in the following table. Note, that although objects 0x2030 and 0x2031 are listed in the set of objects for Digital Input Function Block, they don't have control over the Digital Input Read State (0x6000) unless the input is configured as analog as shown in Figure 4.

Index (hex)	*Object*	*Object Type*	*Data Type*	*Access*	*PDO Mapping*
2030	DI Low Threshold	ARRAY	UNSIGNED16	RW	No
2031	DI High Threshold	ARRAY	UNSIGNED16	RW	No
6000	DI Read State Input Lines	ARRAY	UNSIGNED8	RO	Yes
6002	DI Polarity Input Lines	ARRAY	UNSIGNED8	RW	No

3.3.1 Object 2030h: DI Low Threshold

This object is used for setting the **lowest** analog voltage level, which is considered as digital low in the input. **Note, that the voltage value is given in mV**. This object has control over the digital input objects' state only if the input is configured as any of the analog input types.

Object Description

Index	2030h
Name	DI Low Threshold
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Digital low threshold
Access	RW
PDO Mapping	No
Value Range	0xFFFF
Default Value	1000

3.3.2 Object 2031h: DI High Threshold

This object is used for setting the highest analog voltage level, which is considered as digital high in the input. **Note, that the voltage value is given in mV**. This object has control over the digital input objects' state only if the input is configured as any of the analog input types.

Object Description

Index	2031h
Name	DI High Threshold
Object Type	ARRAY

Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Digital high threshold
Access	RW
PDO Mapping	No
Value Range	0xFFFF
Default Value	4000

3.3.3 Object 6000h: DI Read State Input Line

This object is used for reading the state of digital input line (in 8-bit block).

Object Description

Index	6000h
Name	DI Read State Input Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Digital Input State
Access	RO
PDO Mapping	Yes
Value Range	0, 1

3.3.4 Object 6002h: DI Polarity Input Line

This object is used for setting the polarity of digital input line (in 8-bit block). For proportional inputs that are not configured as digital, the corresponding bit is ignored. When the bit is set, inverse polarity is active.

Object Description

Index	6002h
Name	DI Polarity Input Line
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Line polarity
Access	RW
PDO Mapping	No
Value Range	Bit Value 0 = Inverse polarity Bit Value 1 = Normal polarity
Default Value	1h

3.4 ANALOG OUTPUT FUNCTION BLOCK (DS-404)

The application and manufacturer objects supported by the Single Channel CAN Controller for the analog output block are listed in the following table.

Index (hex)	*Object*	*Object Type*	*Data Type*	*Access*	*PDO Mapping*
2000	Control Function X-points	ARRAY	UNSIGNED16	RW	No
2010	Control Function Y-points	ARRAY	UNSIGNED16	RW	No
2020	Control Function Point State	ARRAY	UNSIGNED16	RW	No
3000	AO Hotshot Value	ARRAY	INTEGER16	RW	No
3001	AO Hotshot Hold Time	ARRAY	UNSIGNED16	RW	No
30D0	AO Error Flag Delay	ARRAY	UNSIGNED16	RW	No
3100	AO Current Minimum	ARRAY	INTEGER16	RW	No
3101	AO Voltage Minimum	ARRAY	INTEGER16	RW	No
3102	AO PWM Duty Cycle Minimum	ARRAY	INTEGER16	RW	No
3200	AO Current Maximum	ARRAY	INTEGER16	RW	No
3201	AO Voltage Maximum	ARRAY	INTEGER16	RW	No
3202	AO PWM Duty Cycle Maximum	ARRAY	INTEGER16	RW	No
3300	AO Dither Frequency	ARRAY	UNSIGNED16	RW	No
3301	AO Dither Amplitude	ARRAY	UNSIGNED16	RW	No
3302	AO Ramp Up	ARRAY	UNSIGNED16	RW	No
3303	AO Ramp Down	ARRAY	UNSIGNED16	RW	No
3304	AO Ramp Control	ARRAY	UNSIGNED8	RW	No
3310	AO On / Off Switching Frequency	ARRAY	UNSIGNED8	RW	No
33C0	AO Measured Current	ARRAY	UNSIGNED16	RO	Yes
3400	Controller Kp	ARRAY	UNSIGNED32	RW	No
3401	Controller Ki	ARRAY	UNSIGNED32	RW	No
3402	Controller Kd	ARRAY	UNSIGNED32	RW	No
3500	Sensor Averaging Time	ARRAY	UNSIGNED16	RW	No
6302	AO Decimal Digits PV	ARRAY	UNSIGNED16	RW	No
6310	AO Output Type	ARRAY	UNSIGNED8	RW	No
6311	AO Output Control	ARRAY	UNSIGNED8	RW	No
6321	AO Control Function Control	ARRAY	UNSIGNED8	RW	No
7300	AO Output Process Value	ARRAY	INTEGER16	RO	No
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	RW	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

3.4.1 Object 2000h: Control Function X-Points

This object defines the Single Channel CAN Controller's control function x-points. See section 2.2 for more detailed description of the control function use.

Object Description

Index	2000h

Name	Control Function X-Points
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	11
Default Value	11

Subindex	1h
Description	point 0 X, see Table 2
Access	RO
PDO Mapping	No
Value Range	0
Default Value	0

Subindex	2h to Ah
Description	X-points, 1 X to 9 X, see Table 2
Access	RW
PDO Mapping	No
Value Range	0-1000
Default Value	See section 2.2

Subindex	Bh
Description	X-point 10, see Table 2
Access	RO
PDO Mapping	No
Value Range	1000
Default Value	1000

3.4.2 Object 2010h: Control Function Y-Points

This object defines the Single Channel CAN Controller's control function y-points. See section 2.2 for more detailed description of the control function use.

Object Description

Index	2010h
Name	Control Function Y-Points
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	11
Default Value	11

Subindex	1h to Bh

Description	Y-points, Y0 to Y10, see Table 2
Access	RW
PDO Mapping	No
Value Range	0-1000
Default Value	0

3.4.3 Object 2020h: Control Function Point State

This object defines the Single Channel CAN Controller's control function point states. See section 2.2 for more detailed description of the control function use.

Object Description

Index	2020h
Name	Control Function Point State
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	11
Default Value	11

Subindex	1h
Description	Point 0 State, see Table 2
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	2h to Ah
Description	Point 1 to 9 States, see Table 2
Access	RW
PDO Mapping	No
Value Range	0,1
Default Value	0

Subindex	Bh
Description	Point 10 State, see Table 2
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

3.4.4 Object 3000h: AO Hotshot Hold Value

This object is used to set the value for the output after the hotshot delay time (3001h) has passed. The hotshot hold value is only applied if the output resides in the last region of the control function. Note that this object is used only in the control function block.

Object Description

Index	3000h
Name	AO Hotshot Hold Value
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Hotshot Value
Access	RW
PDO Mapping	No
Value Range	0 … 24000 [mV], 0 … 2000 [mA], 0 … 100 [%]
Default Value	0

3.4.5 Object 3001h: AO Hotshot Delay Time

This object is used to set the duration of the hotshot value, i.e. the control function y-value on the last segment. After this time has elapsed, the output value is set to value specified by 3000h, hotshot hold value. Note that this object is used only in the control function block.

Object Description

Index	3001h
Name	AO Hotshot Delay Time
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Hotshot Delay Time
Access	RW
PDO Mapping	No
Value Range	0 … 10000 (0x2710) [ms]
Default Value	0

3.4.6 Object 30D0h: AO Error Flag Delay

This object is used to prevent intermittent proportional output faults from overloading the bus with error messages. The value is defined as a multiple of 1ms. If a fault has been present during the entirety of the delay time, the Single Channel CAN Controller will flag an error at the output once the timer has expired. The object can be set to zero, in which case a fault will immediately trigger an error response.

Object Description

Index	30D0h
Name	AO Error Flag Delay
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Error Delay, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 1000 [ms]
Default Value	500 (0x1F4)

3.4.7 Object 3100h: AO Current Minimum

This object defines the minimum current value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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	3100h
Name	AO Current Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum current, OUT1

Access	RW
PDO Mapping	No
Value Range	0 … 2000 [mA]
Default Value	0

3.4.8 Object 3101h: AO Voltage Minimum

This object defines the minimum voltage value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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	3101h
Name	AO Voltage Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum voltage, OUT1
Access	RW
PDO Mapping	No
Value Range	0 … 24000 [mV]
Default Value	0

3.4.9 Object 3102h: AO PWM Duty Cycle Minimum

This object defines the minimum PWM duty cycle value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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	3102h
Name	AO PWM Duty Cycle Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum PWM duty cycle, OUT1
Access	RW
PDO Mapping	No
Value Range	0 … 100 [%]
Default Value	0

3.4.10 Object 3200h: AO Current Maximum

This object defines the maximum current value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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 Current Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum current, OUT1
Access	RW
PDO Mapping	No
Value Range	0 … 2000 [mA]
Default Value	2000

3.4.11 Object 3201h: AO Voltage Maximum

This object defines the maximum voltage value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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	3201h
Name	AO Voltage Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1

Default Value	1

Subindex	1h
Description	Maximum voltage, OUT1
Access	RW
PDO Mapping	No
Value Range	0 … 24000 [mV]
Default Value	24000

3.4.12 Object 3202h: AO PWM Duty Cycle Maximum

This object defines the maximum PWM duty cycle value for the output. This value is used in the control signal normalization process. See chapter 2 for details. 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	3202h
Name	AO PWM Duty Cycle Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum PWM duty cycle, OUT1
Access	RW
PDO Mapping	No
Value Range	0 … 100 [%]
Default Value	100

3.4.13 Object 3300h: AO Dither Frequency

This object defines the frequency of the dither that will be superimposed on top of the output signal for the proportional outputs. The value is defined as a multiple of 1Hz.

Object Description

Index	3300h
Name	AO Dither Frequency
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No

Value Range	1
Default Value	1

Subindex	1h
Description	Dither Frequency, OUT1
Access	RW
PDO Mapping	No
Value Range	20 to 400 [Hz]
Default Value	100 [Hz]

3.4.14 Object 3301h: AO Dither Amplitude

This object defines the amplitude of the dither that will be superimposed on top of the output signal for the proportional outputs. The value is defined as percents. Dithering is disabled if this is set to zero.

Object Description

Index	3301h
Name	AO Dither Amplitude
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Dither Amplitude, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 40 [%]
Default Value	5 [%]

3.4.15 Object 3302h: AO Ramp Up

This object defines the length of time it would take for the output current to ramp up from zero to 2000mA, 24V, or 100%dc depending on the Output Type (0x6310). The value is defined as a multiple of 1ms.

Object Description

Index	3302h
Name	AO Ramp Up
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries

Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Ramp Up, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 10000 [ms]
Default Value	0

3.4.16 Object 3303h: AO Ramp Down

This object defines the length of time it would take for the output current to ramp down to zero from 2000mA, 24V, or 100%dc depending on the Output Type (0x6310). The value is defined as a multiple of 1ms.

Object Description

Index	3303h
Name	AO Ramp Down
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Ramp Down, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 10000 [ms]
Default Value	0 [ms]

3.4.17 Object 3304h: AO Ramp Control

This object defines whether or not the controller will use ramps when adjusting the output current. Ramps are a useful feature to prevent an abrupt jump in the current in the case of a large step change at the input. In the case of an emergency shutoff due to a fault condition, ramps are never used. See section 4 for more details about error responses in the Single Channel CAN Controller. The following values are allowed for this object.

- Ramp Control 0 = Ramps are disabled
- Ramp Control 1 = Always use ramps (except in emergency shutoffs)

Only the mentioned ramp controls 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 1.

Object Description

Index	3304h
Name	AO Ramp Control
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Ramp Control, OUT1
Access	RW
PDO Mapping	No
Value Range	0 (no ramps), 1 (uses ramps)
Default Value	1

3.4.18 Object 3310h: AO On / Off Switching Frequency

This object defines the frequency of on/off switching for output types 5 and 6 in Hz. Only the mentioned range of frequencies is 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.

Object Description

Index	3310h
Name	AO On / Off Switching Frequency
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Sw. Frequency, OUT1
Access	RW
PDO Mapping	No

Value Range	0 – 50 (Hz)
Default Value	0

3.4.19 Object 33C0h: AO Measured Current

This object indicates the actual current applied to the loads as measured by the controller. The value is defined as a multiple of 1mA.

Object Description

Index	33C0h
Name	AO Measured Current
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Measured Current, OUT1
Access	RO
PDO Mapping	Yes OUT1 default TPDO2, subindex 1
Value Range	0 to 2000 [mA]
Default Value	No

3.4.20 Object 3400h: Controller KP

This object defines the proportional gain used in the PID controller. Subindex 2 holds the password, which needs to be entered in order the new value is applied. See section 2 for details. The password for taking the new value in use is “save”. Note, that in order to save the new value into non-volatile memory of the controller, a manufacturer data save needs to be issued (object 0x1010) after issuing “save” to subindex 2 of this object.

Object Description

Index	3400h
Name	Controller KP
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	Controller Kp
Access	RW
PDO Mapping	No
Value Range	0 … 10000
Default Value	1500

Subindex	2h
Description	Password for Kp
Access	RW
PDO Mapping	No
Value Range	0x65766173
Default Value	1

3.4.21 Object 3401h: Controller KI

This object defines the integral gain used in the PID controller. Subindex 2 holds the password, which needs to be entered in order the new value is applied. See section 2 for details. The password for taking the new value in use is “save”. Note, that in order to save the new value into non-volatile memory of the controller, a manufacturer data save needs to be issued (object 0x1010) after issuing “save” to subindex 2 of this object.

Object Description

Index	3401h
Name	Controller KI
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	Controller Ki
Access	RW
PDO Mapping	No
Value Range	0 … 10000
Default Value	10

Subindex	2h
Description	Password for Ki
Access	RW
PDO Mapping	No
Value Range	0x65766173
Default Value	1

3.4.22 Object 3402h: Controller KD

This object defines the derivative gain used in the PID controller. Subindex 2 holds the password, which needs to be entered in order the new value is applied. See section 2 for details. The password for taking the new value in use is “save”. Note, that in order to save the new value into non-volatile memory of the controller, a manufacturer data save needs to be issued (object 0x1010) after issuing “save” to subindex 2 of this object.

Object Description

Index	3402h
Name	Controller KD
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	Controller Kd
Access	RW
PDO Mapping	No
Value Range	0 … 10000
Default Value	0

Subindex	2h
Description	Password for Kd
Access	RW
PDO Mapping	No
Value Range	0x65766173
Default Value	1

3.4.23 Object 3500h: Sensor Averaging Time

This object defines the sensor averaging time for input measurements. See section 2 for details.

Object Description

Index	3500h
Name	Sensor Averaging Time
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Averaging Time
Access	RW
PDO Mapping	No
Value Range	0 … 1000 [ms]
Default Value	100

3.4.24 Object 7300h: AO Output Process Value

This object is the process value that is fed into the analog output function block. (See Figure 5) Since this is a read-only object, the only way this object is written is if the value in object 7F50h [Received PV] is validated by object 6F52h. The process value can be in any physical unit (bar, rpm, etc.) or in any custom format. The output value is scaled into the field value 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Process Value, OUT1
Access	RW
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

3.4.25 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	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No

Value Range	1
Default Value	1

Subindex	1h
Description	Decimal Digits PV, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

3.4.26 Object 6310h: AO Output Type

This object defines the type of the output. If configured as a digital output (on/off), the analog output block will no longer apply. Instead, the digital output block will apply to the output. The following values are allowed for this object.

- Output Type 0 = output disabled
- Output Type 1 = discrete (on/off digital)
- Output Type 2 = proportional current (0-2A)
- Output Type 3 = proportional voltage (0 to 24V)
- Output Type 4 = PWM duty cycle (0 to 100%)
- Output Type 5 = Switching current (0 – 50Hz)
- Output Type 6 = Switching voltage (0 – 50Hz)

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 3, voltage output.

Object Description

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

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Output Type, OUT1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3, 4, 5, 6
Default Value	3 (voltage)

3.4.27 Object 6311h: AO Output Control

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

- Control Type 0 = output control disabled
- Control Type 1 = universal input
- Control Type 2 = control function
- Control Type 3 = PWM output current
- Control Type 4 = CAN messages
- Control Type 5 = Operating voltage
- Control Type 6 = Chip temperature

Only the mentioned control 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 4, control via CAN messages.

Object Description

Index	6311h
Name	AO Output Control
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Output Control Type, OUT1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3, 4, 5, 6
Default Value	4 (CAN)

3.4.28 Object 6321h: AO Control Function Control

This object defines the type of the input used for the control function. The following values are allowed for this object.

- Control Type 0 = control disabled
- Control Type 1 = universal input
- Control Type 2 = control function
- Control Type 3 = PWM output current
- Control Type 4 = CAN messages
- Control Type 5 = Operating voltage
- Control Type 6 = Chip temperature

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, control disabled

Object Description

Index	6321h
Name	AO Control Function Control
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Control function control type
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3, 4, 5, 6
Default Value	0 (disabled)

3.4.29 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 1 PV, OUT1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

3.4.30 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 1 FV, OUT1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

3.4.31 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 2 PV, OUT1
Access	RW

PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

3.4.32 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 2 FV, OUT1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

3.4.33 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. Alternatively, it can be written to directly to set the output, as long as the corresponding bit in object 6F52h [Received PV status] is set to invalid. The value is defined as a multiple of 1mA. 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
Access	RO
PDO Mapping	No
Value Range	1

Default Value	1

Subindex	1h
Description	Field Value
Access	RW
PDO Mapping	Yes
Value Range	0 to 2000 [mA], 0 to 24000 [mV], 0 to 100 [%]
Default Value	0

3.4.34 Object 6340h: AO Fault Mode

This object defines the fault mode response for proportional outputs. For proportional outputs that are configured as digital, the corresponding subindex is ignored. It determines whether the output shall continue to operate normally when the Single Channel CAN Controller detects an error, or if the output shall be driven to the value defined in object 7341h. For more details about the Single Channel CAN Controller, see section 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Fault Mode, OUT1
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0

3.4.35 Object 7341h: AO Fault FV

This object defines the value that proportional outputs will be driven to in fault situations. For proportional outputs that are configured as digital, the object is ignored. Value range of this object depends on the selected output type.

Object Description

Index	7341h
Name	AO Fault FV

Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Fault FV, OUT1
Access	RW
PDO Mapping	No
Value Range	0 to 2000 [mA], 0 to 24000 [mV], 0 to 100 [%]
Default Value	0

3.4.36 Object 7F50h: Received PV 16

This object is a generic input process value that is used to write to the analog output 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Received PV, OUT1
Access	RW
PDO Mapping	Yes
Value Range	INTERGER16
Default Value	0

3.4.37 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 7330h [AO Output FV] is allowed at any time, thus the field value can be used to control the outputs, 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
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	PV Status, OUT1
Access	RW
PDO Mapping	Yes
Value Range	0, 1
Default Value	0 (Received PV invalid)

3.5 ANALOG INPUT FUNCTION BLOCK (DS-404)

The application and manufacturer objects supported by the Single Channel CAN Controller for the analog input block are listed in the following table.

Index (hex)	*Object*	*Object Type*	*Data Type*	*Access*	*PDO Mapping*
20A0	AI Error Minimum	ARRAY	UNSIGNED16	RW	No
20B0	AI Error Maximum	ARRAY	UNSIGNED16	RW	No
20C0	AI Enable Error Checking Input	ARRAY	UNSIGNED8	RW	No
20D0	AI Error Flag Delay	ARRAY	UNSIGNED16	RW	No
2100	Input Voltage Range	ARRAY	UNSIGNED8	RW	No
2110	Input Current Range	ARRAY	UNSIGNED8	RW	No
2120	Input Frequency Range	ARRAY	UNSIGNED8	RW	No
2130	Input Pull Up/Down Mode	ARRAY	UNSIGNED8	RW	No
2140	Debounce Input Filter	ARRAY	UNSIGNED8	RW	No
2150	AI Input Filter Type	ARRAY	UNSIGNED8	RW	No
2200	AI Voltage Minimum	ARRAY	UNSIGNED16	RW	No
2201	AI Current Minimum	ARRAY	UNSIGNED16	RW	No
2202	AI Resistance Minimum	ARRAY	UNSIGNED16	RW	No
2203	AI Frequency Minimum	ARRAY	UNSIGNED16	RW	No
2204	AI PWM Duty Cycle Minimum	ARRAY	UNSIGNED16	RW	No
2300	AI Voltage Maximum	ARRAY	UNSIGNED16	RW	No
2301	AI Current Maximum	ARRAY	UNSIGNED16	RW	No
2302	AI Resistance Maximum	ARRAY	UNSIGNED16	RW	No
2303	AI Frequency Maximum	ARRAY	UNSIGNED16	RW	No
2304	AI PWM Duty Cycle Maximum	ARRAY	UNSIGNED16	RW	No
6112	Input Type	ARRAY	UNSIGNED8	RW	No
6125	AI Autozero	ARRAY	UNSIGNED32	WO	No
6132	AI Decimal Digits PV	ARRAY	UNSIGNED16	RW	No
7100	AI Input Field Value	ARRAY	INTEGER16	RO	Yes
7120	AI Input Scaling 1 PV	ARRAY	INTEGER16	RW	No
7121	AI Input Scaling 1 FV	ARRAY	INTEGER16	RW	No
7122	AI Input Scaling 2 PV	ARRAY	INTEGER16	RW	No
7123	AI Input Scaling 2 FV	ARRAY	INTEGER16	RW	No
7124	AI Input Offset	ARRAY	INTEGER16	RW	No
7130	AI Input Process Value	ARRAY	INTEGER16	RO	Yes

3.5.1 Object 20A0h: AI Error Minimum

This object is the minimum error-free input measurement value. If the input drops below this value, error is flagged.

Object Description

Index	20A0h
Name	AI Error Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Error value, minimum, IN1
Access	RW
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0

3.5.2 Object 20B0h: AI Error Maximum

This object is the maximum error-free input measurement value. If the input rises above this value, error is flagged.

Object Description

Index	20A0h
Name	AI Error Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Error value, maximum, IN1
Access	RW
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	5000

3.5.3 Object 20C0h: AI Enable Error Checking Input

This object defines whether or not the controller will compare the measured input value with values described in objects 0x20A0 and 0x20B0.

Object Description

Index	20C0h
Name	AI Enable Error Checking Input
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Error Checking Control, IN1
Access	RW
PDO Mapping	No
Value Range	0 (no checking), 1 (checking)
Default Value	0

3.5.4 Object 20D0h: AI Error Flag Delay

This object is used to prevent intermittent input faults from overloading the bus with error messages. The value is defined as a multiple of 1ms. If a fault has been present during the entirety of the delay time, the Single Channel CAN Controller will flag an error at the input once the timer has expired. The object can be set to zero, in which case a fault will immediately trigger an error response.

Object Description

Index	20D0h
Name	AI Error Flag Delay
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Error Delay, IN1
Access	RW
PDO Mapping	No
Value Range	0 to 1000 [ms]
Default Value	500

3.5.5 Object 2100h: Input Voltage Range

This object defines the voltage range used when measuring input values. If the input is configured to any other type than voltage, this object does not apply. The following values are allowed for this object.

- Range 0 = 0V – 10V range
- Range 1 = 0V – 5V range
- Range 2 = 0V – 2.5V range
- Range 3 = 0V – 1V range

Only the mentioned input ranges 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 1, 0-5V input. Note, that changing this object will set the corresponding default minimum and maximum values to objects 2200h and 2300h.

Object Description

Index	2100h
Name	Input Voltage Range
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Type, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3
Default Value	1 (0-5V range)

3.5.6 Object 2110h: Input Current Range

This object defines the current range used when measuring input values. If the input is configured to any other type than current, this object does not apply. The following values are allowed for this object.

- Range 0 = 0mA – 20mA range
- Range 1 = 4mA – 20mA range

Only the mentioned input ranges 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, 0-20mA input. Note, that changing this object will set the corresponding default minimum and maximum values to objects 2201h and 2301h.

Object Description

Index	2110h
Name	Input Current Range
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Type, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1
Default Value	0 (0-20mA range)

3.5.7 Object 2120h: Input Frequency Range

This object defines the frequency range used when measuring input values. If the input is configured to any other type than frequency, this object does not apply. The following values are allowed for this object.

- Range 0 = 10Hz – 1kHz range
- Range 1 = 100Hz – 10kHz range

Only the mentioned input ranges 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, 10Hz-1kHz input. Note, that changing this object will set the corresponding default minimum and maximum values to objects 2203h and 2303h.

Object Description

Index	2120h
Name	Input Frequency Range
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Type, IN1
Access	RW
PDO Mapping	No

Value Range	0, 1
Default Value	0

3.5.8 Object 2130h: Input Pull Up/Down Mode

This object sets the possible onboard pull-up / pull-down resistor use. If the input is configured to any other type than discrete, this object does not apply. The following values are allowed for this object.

- Mode 0 = do not use pull up/down resistors
- Mode 1 = use 10kOhm pull up
- Mode 2 = use 10kOhm pull down

Only the mentioned values 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, no pull up/down in use.

Object Description

Index	2130h
Name	Input Pull Up/Down Mode
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Pull Up/Down Mode, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2
Default Value	0 (no pull up/down in use)

3.5.9 Object 2140h: Debounce Input Filter

Debounce input digital filter is used when measuring frequency and PWM duty cycle. If the input is of any other type, this object does not apply. The following values are allowed for this object.

- Mode 0 = do not use debounce filter
- Mode 1 = Debounce filter 111ns
- Mode 2 = Debounce filter 1.78us
- Mode 3 = Debounce filter 14.22us

Only the mentioned values 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, no filter in use.

Object Description

Index	2140h
Name	Debounce Input Filter
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Debounce Filter, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3
Default Value	2

3.5.10 Object 2150h: AI Input Filter Type

AI Input Filter filters out industrial noise for voltage, current and resistance measurements If the input is of any other type, this object does not apply. The following values are allowed for this object.

- Mode 0 = do not use input filter
- Mode 1 = Input filter 50Hz
- Mode 2 = Input filter 60Hz
- Mode 3 = Input filter 50Hz and 60Hz

Only the mentioned values 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, no filter in use.

Object Description

Index	2150h
Name	Debounce Input Filter
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO

PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Filter, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3
Default Value	3

3.5.11 Object 2200h: AI Voltage Minimum

This object defines the minimum voltage value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2200h
Name	AI Voltage Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum voltage, IN1
Access	RW
PDO Mapping	No
Value Range	0xFFFF
Default Value	0

3.5.12 Object 2201h: AI Current Minimum

This object defines the minimum current value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2201h
Name	AI Current Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum current, IN1
Access	RW
PDO Mapping	No
Value Range	0xFFFF
Default Value	0

3.5.13 Object 2202h: AI Resistance Minimum

This object defines the minimum resistance value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2202h
Name	AI Resistance Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum resistance, IN1
Access	RW
PDO Mapping	No
Value Range	1 … 30000 [10*Ohm]
Default Value	1

3.5.14 Object 2203h: AI Frequency Minimum

This object defines the minimum frequency value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2203h
Name	AI Frequency Minimum

Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum frequency, IN1
Access	RW
PDO Mapping	No
Value Range	10 … 1000, 10 … 10000
Default Value	10

3.5.15 Object 2204h: AI PWM Duty Cycle Minimum

This object defines the minimum PWM Duty Cycle value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2204h
Name	AI PWM Duty Cycle Minimum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Minimum PWM Duty Cycle, IN1
Access	RW
PDO Mapping	No
Value Range	0 … 100
Default Value	0

3.5.16 Object 2300h: AI Voltage Maximum

This object defines the maximum voltage value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2300h
Name	AI Voltage Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum voltage, IN1
Access	RW
PDO Mapping	No
Value Range	0 … 10000
Default Value	5000

3.5.17 Object 2301h: AI Current Maximum

This object defines the maximum current value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2301h
Name	AI Current Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum current, IN1
Access	RW
PDO Mapping	No
Value Range	0 … 20000, 40 … 20000
Default Value	20000

3.5.18 Object 2302h: AI Resistance Maximum

This object defines the maximum resistance value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the

controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2302h
Name	AI Resistance Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum resistance, IN1
Access	RW
PDO Mapping	No
Value Range	1 … 30000 [10*Ohm]
Default Value	30000

3.5.19 Object 2303h: AI Frequency Maximum

This object defines the maximum frequency value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2303h
Name	AI Frequency Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum frequency, IN1
Access	RW
PDO Mapping	No
Value Range	10 … 1000, 10 … 10000
Default Value	1000

3.5.20 Object 2304h: AI PWM Duty Cycle Maximum

This object defines the maximum PWM Duty Cycle value for the input. This value is used in the control signal normalization process. See chapter 2 for details. Note, that this value is internal to the controller. The PV and FV Scaling coefficients (0x7120, 0x7121, 0x7122 and 0x7123) are the preferred objects for minimum and maximum values setting.

Object Description

Index	2304h
Name	AI PWM Duty Cycle Maximum
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Maximum PWM Duty Cycle, IN1
Access	RW
PDO Mapping	No
Value Range	0 … 100
Default Value	100

3.5.21 Object 6112h: Input Type

This object defines the type of the input. If configured as a digital input, the analog input block will no longer apply. The following values are allowed for this object.

- Input Type 0 = output disabled
- Input Type 1 = voltage
- Input Type 2 = current
- Input Type 3 = resistance
- Input Type 4 = discrete (on/off)
- Input Type 5 = frequency
- Input Type 6 = PWM duty cycle

Only the mentioned input 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 1, voltage input.

Object Description

Index	6112h
Name	Input Type
Object Type	ARRAY
Data Type	UNSIGNED8

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input Type, IN1
Access	RW
PDO Mapping	No
Value Range	0, 1, 2, 3, 4, 5, 6
Default Value	1 (voltage)

3.5.22 Object 6125h: AI Autozero

This object supports the automatic offset setting in such value, that the current measured field value becomes zero. In order to avoid setting offset by mistake, autozero is only executed when a specific signature is written to the appropriate subindex. The signature is “zero”.

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

MSB			LSB
o	r	e	z
6Fh	72h	65h	7Ah

On reception of the correct signature to an appropriate subindex, the Single Channel CAN Controller will calculate new offset, and then confirm the SDO transmission.

Object Description

Index	6125h
Name	AI Autozero
Object Type	ARRAY
Data Type	UNSIGNED32

Entry Description

Subindex	0h
Description	Largest subindex supported
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Autozero, IN1
Access	RW
PDO Mapping	No
Value Range	0x6F72657A (write access)/ 1h (read access)
Default Value	0

3.5.23 Object 6132h: AI Decimal Digits PV

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

Object Description

Index	6132h
Name	AI Decimal Digits PV
Object Type	ARRAY
Data Type	UNSIGNED16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Decimal Digits PV, IN1
Access	RW
PDO Mapping	No
Value Range	0 to 9
Default Value	0

3.5.24 Object 7100h: AI Input Field Value

This object holds the field value of the proportional inputs. The FV is automatically updated if the measured input value is changed. The value is defined as a multiple of 1mA.

Object Description

Index	7100h
Name	AI Input Field Value
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Field Value
Access	RO
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

3.5.25 Object 7120h: AI Input Scaling 1 PV

This object defines the process value for the first calibration point for the input channel. The value is scaled in the physical unit of the input process value, object 7130h.

Object Description

Index	7120h
Name	AI Input Scaling 1 PV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 1 PV, IN1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

3.5.26 Object 7121h: AI Input Scaling 1 FV

This object defines the field value for the first calibration point for the input channel. The value is scaled in the physical unit of the input field value, object 7100h.

Object Description

Index	7321h
Name	AI Input Scaling 1 FV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 1 FV, IN1
Access	RW
PDO Mapping	No

Value Range	INTEGER16
Default Value	0

3.5.27 Object 7122h: AI Input Scaling 2 PV

This object defines the process value for the second calibration point for the input channel. The value is scaled in the physical unit of the input process value, object 7130h.

Object Description

Index	7122h
Name	AI Input Scaling 2 PV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 2 PV, IN1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

3.5.28 Object 7123h: AI Input Scaling 2 FV

This object defines the field value for the second calibration point for the input channel. The value is scaled in the physical unit of the input field value, object 7100h.

Object Description

Index	7123h
Name	AI Input Scaling 2 FV
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Scaling 2 FV, IN1

Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	1000

3.5.29 Object 7124h: AI Input Offset

This object defines offset used with the measured input FV.

Object Description

Index	7124h
Name	AI Input Offset
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h
Description	Input offset, IN1
Access	RW
PDO Mapping	No
Value Range	INTEGER16
Default Value	0

3.5.30 Object 7130h: AI Input Process Value

This object is the process value that is read from the analog input function block. The input value is scaled into the field value using the scaling coefficients defined in objects 7120h to 7123h.

Object Description

Index	7130h
Name	AI Input Process Value
Object Type	ARRAY
Data Type	INTEGER16

Entry Description

Subindex	0h
Description	Number of entries
Access	RO
PDO Mapping	No
Value Range	1
Default Value	1

Subindex	1h

Description	Process Value, IN1
Access	RO
PDO Mapping	Yes
Value Range	INTEGER16
Default Value	0

4.1 Emergency Frame Codes (EMCY)

The EMCY messages include the error code, which is a combination of the general error codes defined in DS-301 and the additional information of the error codes, as defined by DS-404. Object 1003h [Pre-Defined Error Field] maintains a list of all active error codes in the Single Channel CAN Controller.

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.

MSB			**LSB**
Error Description	Channel	EMCY Error Code	

Supported EMCY Codes

EMCY Error Code (hex)	**Meaning**
0000	Error Reset or No Error
2320	Short Circuit at Output
3300	Open Circuit at Output
8130	Life Guard or Heartbeat Error
FF00	Out of Range Low at Input
FF01	Out of Range High at Input

Supported Error Descriptions

Description (hex)	**Meaning**
02	Fault at a digital output
04	Fault at a proportional output
08	Lost Heartbeat or Life Guard from a node

Supported Channel Numbers

Description (hex)	Meaning
01	OUT1

For example, the Single Channel CAN Controller detects a short circuit on proportional output channel 1.

EMCY Code = 0x2320
Additional Information = 0x0401
Resulting Code in 1003h = 0x04012320

4.2 Single Channel CAN Controller Fault Mode Behavior

The objects associated with the error response in the Single Channel CAN Controller are listed in the following table. See section 3 for a detailed description of each object.

Index (hex)	*Object*
1001	Error Register
1003	Pre-Defined Error Field
1029	Error Behavior
30D0	AO Error Response Delay
6340	AO Fault Mode
7341	AO Fault FV

If at any time there is an active fault on the Single Channel CAN Controller, bit 1 (Generic Error) of the Error Register will be set. If and only if there are no active faults will this bit be clear.

If a heartbeat or life-guard event is detected, then the controller will add the appropriate error code (see section 4.1) to the top of the list in object 1003h. The “channel” portion of the error code will contain the node ID of the module that failed to send the heartbeat/life guard message within the expected time. The controller will check subindex 1 (communication) of object 1029h to see if it has to change state.

All other faults that the Single Channel CAN Controller can detect are related to the onboard I/O. Each type of I/O has an object call “Error Response Delay” associated with the various I/O channel. Upon reset of the controller, all possible faults that can be detected by the Single Channel CAN Controller are in the inactive state. When a fault is first detected, it enters an error pending state, and a timer is loaded with the delay time. For a fault to become active, it must remain present until the timer has decremented to zero. If at any time during the delay period the fault is cleared, the fault reverts back to the inactive state, and the delay timer stops. (It is only active while an error is pending.) If the fault is still present when the timer has elapsed, then the fault enters the active state, and the appropriate error code (see section 4.1) is add to the top of the list in object 1003h. For DO and AO faults, the controller will check subindexes 4 and 5 respectively of object 1029h to see if it has to change state.

Pre-Operational Behavior
In the pre-operational state, the controller will not allow any SDO writes to control the outputs of the Single Channel CAN Controller. (PDO communication is disallowed by the standard [DS-301])

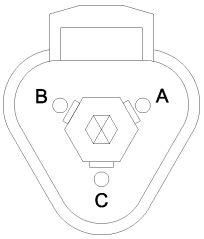
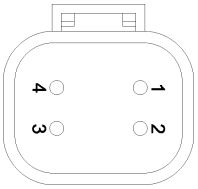
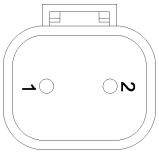
When there is at least one active fault in the controller, the proportional outputs will behave as per objects 6340h and 7341h.

Operational Behavior
In the operational state, the controller behaves as per the descriptions in Section 2.

When there is at least one active fault in the controller, the digital outputs will behave as per objects 6206h and 6207h, while proportional outputs will behave as per objects 6340h and 7341h.

Stopped Behavior
As per the standard [DS-301], the controller stops all communication except for network management functions and node guarding/heartbeat, if active. In the stopped state, all outputs are always off, so objects 6340h and 7341h are ignored.

5 INSTALLATION INSTRUCTIONS

Operating Conditions	-40 to 85 °C (-40 to 185 °F)
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.
Packaging	P/N: AX021602 PCB assembly (conformal coated PCB in heat shrink wrap) with 6 inch (153 mm) 18 WG lead wires terminated with 3 Deutsch IPD DT06 plugs made of thermoplastic with silicone seals and using #16 sized nickel contacts. 1.52 x 17.76 x 0.66 inches or 38.6 x 451.1 x 16.7 mm (W x L x H excluding mating connectors)
Protection	P/N : AX021602 IP50 (PCB conformal coated and housed in heat shrink wrap)
Weight	P/N: AX021602 0.20 lbs. (0.09 kg)
Electrical Connections	**P/N: AX021602** CAN Connector: 3 pin Deutsch IPD P/N: DT04-3P  A: CAN_H (Yellow) B: CAN_L (Green) C: CAN Shield (Grey) Mates with P/N: DT06-3S including W3S wedgelock and sockets. A mating plug kit is available from Axiomatic. Use ordering P/N: AX070104. *(The mating plug kit is comprised of Deutsch IPD P/N: DT06-3S, W3S and 3 contact sockets 0462-201-16141.)* Power and Output Connector: 4 pin Deutsch IPD P/N: DT04-4P  1: Power Input (Red) 2: Power GND (Black) 3: Solenoid + (White/Red) 4: Solenoid – *(Internally connected to Power GND)* (Brown) Mates with P/N: DT06-4S including W4S wedgelock and sockets. A mating plug kit is available from Axiomatic. Use ordering P/N: AX070106. *(The mating plug kit is comprised of Deutsch IPD P/N: DT06-4S, W4S and 4 contact sockets 0462-201-16141.)* Signal Input Connector: 2 pin Deutsch IPD P/N: DT04-2P  1: Signal Input (Blue) 2: Signal GND (Black) Mates with P/N: DT06-2S including W2S wedgelock and sockets. A mating plug kit is available from Axiomatic. Use ordering P/N: AX070107. *(The mating plug kit is comprised of Deutsch IPD P/N: DT06-2S, W2S and 2 contact sockets 0462-201-16141.)*

OUR PRODUCTS

Battery Chargers

CAN bus Controls

Current Converters

DC/DC Power Converters

DC Voltage Signal Converters

Engine Management Controls

Fan Drive Controllers

Gateways

Hydraulic Valve Controllers

I/O Controls

LVDT Simulators

Machine Control Systems

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Position Sensors, Angle Measurement Inclinometers

Power Supplies

PWM Signal Converters

Resolver Signal Conditioners

Service Tools

Signal Conditioners

Surge Suppressors

OUR MISSION

Axiomatic provides electronic machine controls, components, and systems to the off-highway, military, power generation, material handling and industrial OEM markets.

We provide efficient, innovative solutions that focus on adding value for our customers.

We emphasize service and partnership with our customers, suppliers, and employees to build long term relationships and mutual trust.

QUALITY DESIGN AND MANUFACTURING

Axiomatic is an ISO9000:2001 registered facility.

SERVICE

All products to be returned to Axiomatic require a Return Materials Authorization Number (RMA#).

Please provide the following information when requesting an RMA number:

- Serial number, part number
- Axiomatic invoice number and date
- Hours of operation, description of problem
- Wiring set up diagram, application
- Other comments as needed

When preparing the return shipping paperwork, please note the following. The commercial invoice for customs (and packing slip) should state the harmonized international HS (tariff code), valuation and return goods terminology, as shown in italics below. The value of the units on the commercial invoice should be identical to their purchase price.

Goods Made In Canada (or Finland)
Returned Goods for Warranty Evaluation, HS: 9813.00
Valuation Identical Goods
Axiomatic RMA#

WARRANTY, APPLICATION APPROVALS/LIMITATIONS

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CONTACTS

Axiomatic Technologies Corporation
5915 Wallace Street
Mississauga, ON
CANADA L4Z 1Z8
TEL: +1 905 602 9270
FAX: +1 905 602 9279
www.axiomatic.com

Axiomatic Technologies Oy
Höytämöntie 6
33880 Lempäälä
FINLAND
TEL: +358 3 3595 600
FAX: +358 3 3595 660
www.axiomatic.fi