SAUER DANFOSS

PLUS+1 CAN I/O
Module
Communications
Protocol
Technical Information

IOX012-010-00000	IOX024-010-00000	IOX012-010-00000	PLUS+1 Diag Tool

120 Ω   120 Ω

MC 24-10	MC 50-10	MC 24-10
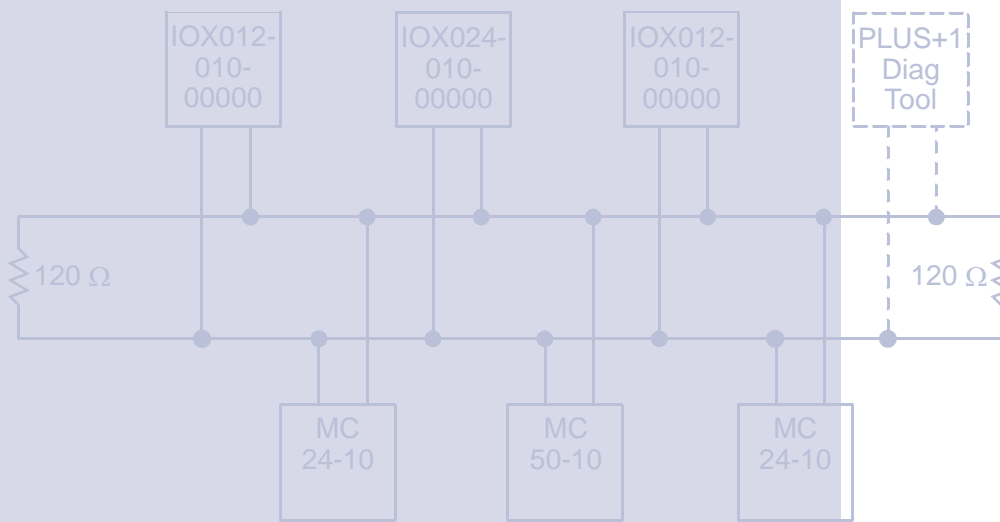
About this Manual

Organization and Headings

To help you quickly find information in this manual, the material is divided into sections, topics, subtopics, and details, with descriptive headings set in red type. Section titles appear at the top of every page in large red type.

In the PDF version of this document, clicking an item *underlined in blue italic type* jumps you to the referenced page in the document.

Special Text Formatting

Controls and indicators are set in **bold black type**.

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Revision History

Date	Change	Remarks
15 December 2005	——	Draft
22 December 2005	Add SUBCMD 19	Draft, protocol version 2.00
23 December 2005	Config values only 8 bit and not 16 bit in SUBCMD 19	Draft, protocol version 2.00
30 January 2006	Add IO_TYPE 6 for digital inputs on SUBCMD 19	Draft, protocol version 2.00
20 April 2006	——	Released
28 September 2007	Add current change limit—SUBCMD 20 Add recovery times—SUBCMD 21 New values in NV—SUBCMD 22	Draft, protocol version 2.01
12 November 2007	Corrected Message Name—Configuration Type Definition table Updated description of recover times—Bus Off Rcvr Time and CAN Drv Error Rcvr Time	Draft, protocol version 2.01
23 November 2007 16 January 2008	Extended CRC message for backwards compatibility—SUBCMD 18	Draft, protocol version 2.02
31 January 2008	——	Released
3 June 2008	Renamed SUBCMD 18 and edited comments	——
21 October 2008	Corrected shown CMD values—CMD69 and CMD70	——
26 February 2009	Corrected shown parameter list—CMD 71 (includes Digital ,Digital_AnIn, and Rheo inputs)	Draft, protocol version 2.04
23 March 2009	Use correct names for CMD69 and CMD70 Changed wording for SUBCMD 18	Draft, protocol version 2.04
25 March 2009	Extended Request Configuration message to backwards compatatible for CRC—SUBCMD 255	Draft, protocol version 2.04
31 March 20009	——	Released
26 March 2010	Added Non-Volatile Memory Storage—SUBCMD 22	Draft, protocol version 2.05
14 April 10	Added CMD71, CMD72, CMD73, and CMD74	Draft, protocol version 2.06
27 July 2010	Clarification on Mask—Configuration Type Definition table	——
27 October 2010	Further clarification on Mask—Configuration Type Definition table	——
1 December 2010	——	Reformat, Rev AA

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In the following section on message structures, the repetition time is specified. If the repetition time is set to zero, then the message is disabled and is not sent. If the repetition time is not zero, then the message is active and is transmitted periodically at the interval specified by the repetition time. (The following tables identify the repetition time as the **Rate**.)

To change the repetition time, use the Configure Timing message (SUBCMD 12.)

Some of the messages are referred to as optimized and others are not. Optimized messages have the designation OPT in the title of the message. Optimized messages have the data for several inputs or outputs of a certain type contained in the message. This minimizes the number of messages needed to be sent on the CAN bus in order to reduce bus traffic.

Non-optimized (regular) messages typically have only the data for a single input or output. In general optimized messages are used as the default so that all data can be communicated between the I/O module and the controller. A system designer has the option of turning off optimized messages and using regular messages instead. Typically, the default set of messages is adequate for most systems.

Supply (CMD 0)

This frame is transmitted from the I/O device continuously with a default cycle time.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x00	Supp[*] (LSB)	Supp[*] (MSB)	Sensor[†] (LSB)	Sensor[†] (MSB)	Shield[‡] (LSB)	Shield[‡] (MSB)	——	500 ms	SUPPLY

[*]Measured supply voltage in mV.

[†]Measured sensor voltage in mV.

[‡]Measured shield voltage in mV.

Dig_In (CMD 16)

This frame is transmitted from the I/O device continuously with a default cycle time. This message has to be activated. By default, packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x10	Channel[*]	DigIn[†]	——	——	——	——	——	0 ms	D_IN

[*]Identifies the channel.

[†]Actual pin status.

Ana/Temp/Rheo (CMD 32)

This frame is transmitted from the I/O device continuously with a default cycle time. This message has to be activated. By default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x20	Channel[*]	Value[†] (LSB)	Value[†] (MSB)	——	——	——	——	0 ms	RHEO

[*]Identifies the channel.

[†]Actual measured value. mV in an analogue configuration; otherwise an Ω value.

Dig and Ana/Temp/Rheo Opt I (CMD 33)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device are set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x21	Value 0* (LSB)	Value 0* (MSB)	Value 1† (LSB)	Value 1† (MSB)	Dig 0_7‡	Dig 8_15§	Dig 16_23#	20 ms	RHEO_OPTI

*Actual measured value of the first channel; mV in an analogue configuration; otherwise an Ω value.

†Actual measured value of the second channel; mV in an analogue configuration; otherwise an Ω value.

‡ Bit pattern for the first 8 digital inputs; bit 0 is channel 0.

§Bit pattern for the next 8 digital inputs; bit 0 is channel 8.

#Bit pattern for the next 8 digital inputs; bit 0 is channel 16.

Dig and Ana/Temp/Rheo Opt II (CMD 34)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default. Only input devices with more than two Ana/Temp/Rheo will transmit this message or if the device has more than 24 digital inputs. Values not available on the I/O device are set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x22	Value 2* (LSB)	Value 2* (MSB)	Value 3† (LSB)	Value 3† (MSB)	Dig 24_31‡	Dig 32_39§	Dig 40_47#	20 ms	RHEO_OPTII

*Actual measured value of the third channel; mV in an analogue configuration; otherwise an Ω value.

†Actual measured value of the fourth channel; mV in an analogue configuration; otherwise an Ω value.

‡Bit pattern for the first 8 digital inputs; bit 0 is channel 24.

§Bit pattern for the next 8 digital inputs; bit 0 is channel 32.

#Bit pattern for the next 8 digital inputs; bit 0 is channel 40.

Dig/Ana (CMD 48)

This frame is transmitted from the I/O device continuously with a default cycle time. This message will only be transmitted if the device does have this type of input. This message has to be activated; by default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x20	Channel*	Value† (LSB)	Value† (MSB)	——	——	——	——	0 ms	RHEO

*Identifies the channel.

†Actual measured value in mV.

Messages Based on the Sub-Identifier

Dig/Ana Opt I (CMD 49)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x31	Value 0* (LSB)	Value 0* (MSB)	Value 1† (LSB)	Value 1† (MSB)	Value 2‡ (LSB)	Value 2‡ (MSB)	Dig 0_2§	20 ms	Dig_ANA_OPTI

*Actual measured value of the first channel in mV.

†Actual measured value of the second channel in mV.

‡Actual measured value of the third channel in mV.

§Bit pattern for the first 3 digital inputs; bit 0 is channel 0.

Dig/Ana Opt II (CMD 50)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x32	Value 3* (LSB)	Value 3* (MSB)	Value 4† (LSB)	Value 4† (LSB)	Value 5‡ (LSB)	Value 5‡ (LSB)	Dig 3_5§	20 ms	Dig_ANA_OPTII

*Actual measured value of the fourth channel in mV.

†Actual measured value of the fifth channel in mV.

‡Actual measured value of the sixth channel in mV.

§Bit pattern for the next 2 digital inputs; bit 0 is channel 3.

Dig/Ana/Freq (CMD 64)

This frame is transmitted from the I/O device continuously with a default cycle time. This message will only be transmitted if the device does have this type of input. This message has to be activated; by default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x40	Channel*	Value† (LSB)	Value† (MSB)	Freq‡ (LSB)	Freq‡ (MSB)	DigIn§	——	0 ms	DIG_ANA_FREQ

*Indicates the channel.

†Actual measured value in mV.

‡Actual measured frequency.

§Status of the digital input.

Dig/Ana/Freq Opt I (CMD 65)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x41	Value 0[*] (LSB)	Value 0[*] (MSB)	Value 1[†](LSB)	Value 1[†](MSB)	Value 2[‡](LSB)	Value 2[‡](MSB)	Dig 0_2[§]	50 ms	DIG_ANA_FREQ_OPTI

[*]Actual measured value in mV on the first analogue input.

[†]Actual measured value in mV on the second analogue input.

[‡]Actual measured value in mV on the third analogue input.

[§]Bit pattern of the first 3 digital inputs; bit 0 is channel 0.

Dig/Ana/Freq Opt II (CMD 66)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x42	Value 3[*](LSB)	Value 3[*](MSB)	Value 4[†](LSB)	Value 4[†]MSB)	Value 5[‡](LSB)	Value 5[§](MSB)	Dig 3_5[#]	50 ms	DIG_ANA_FREQ_OPTI

[*]Actual measured value in mV on the fourth analogue input.

[†]Actual measured value in mV on the fifth analogue input.

[‡]Actual measured value in mV on the sixth analogue input.

[#]Bit pattern of the fourth, fifth, and sixth digital input; bit 0 is channel 4.

Dig/Ana/Freq Opt III (CMD 67)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x43	Freq 0[*] (LSB)	Freq 0[*] (MSB)	Freq 1[†] (LSB)	Freq 1[†] (MSB)	Freq 2[‡] (LSB)	Freq 2[‡] (MSB)		50 ms	DIG_ANA_FREQ_OPTIII

[*]Actual measured frequency in Hz on the first input.

[†]Actual measured frequency in Hz on the second input.

[‡]Actual measured frequency in Hz on the third input.

Dig/Ana/Freq Opt IV (CMD 68)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x44	Freq 3* (LSB)	Freq 3* (MSB)	Freq 4† (LSB)	Freq 4† (MSB)	Freq 5‡ (LSB)	Freq 5‡ (MSB)	——	50 ms	DIG_ANA_FREQ_OPTIV

*Actual measured frequency in Hz on the fourth input.

†Actual measured frequency in Hz on the fifth input.

‡Actual measured frequency in Hz on the sixth input.

Dig/Ana/Freq Opt V(CMD 69)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x45	Value 6* (LSB)	Value 6* (MSB)	Value 7† (LSB)	Value 7† (MSB)	Value 8‡ (LSB)	Value 8‡ (MSB)	Dig 6_8§	50 ms	DIG_ANA_FREQ_OPTV

*Actual measured value in mV on the seventh analogue input.

†Actual measured value in mV on the eighth analogue input.

‡Actual measured value in mV on the ninth analogue input.

§Bit pattern of the seventh, eighth, and ninth digital input; bit 0 is channel 7.

Dig/Ana/Freq Opt VI (CMD 70)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x46	Freq 6* (LSB)	Freq 6* (MSB)	Freq 7† (LSB)	Freq 7† (MSB)	Freq 8‡ (LSB)	Freq 8‡ (MSB)	——	50 ms	DIG_ANA_FREQ_OPTVI

*Actual measured frequency in Hz on the seventh input.

†Actual measured frequency in Hz on the eighth input.

‡Actual measured frequency in Hz on the ninth input.

Dig/Ana/Freq Opt VII (CMD 71)

This frame is transmitted from the I/O device continuously with a default cycle time. This message will only be transmitted if the device does have this type of input. This message has to be activated; by default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x47	Channel[*]	Value[†](LSB)	Value[†] (MSB)	Freq[‡] (LSB)	Freq[‡] (MSB)	Period[§] (LSB)	Period (MSB) DigIn[#]	0 ms	DIG_ANA_FREQ_OPTVII

[*]Indentifies the channel.

[†]Actual measured value in mV.

[‡]Actual measured frequency.

[§]Actual measured period (15-bit).

[#]Status of the digital input (MSB of CAN B 7).

Dig/Ana/Freq Opt VIII (CMD 72)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and has to be activated if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x48	Per 0[*] (LSB)	Per 0[*] (MSB)	Per 1[†] (LSB)	Per 1[†] (MSB)	Per 2[‡] (LSB)	Per 2[‡] (MSB)	——	0 ms	DIG_ANA_FREQ_OPTVIII

[*]Actual measured period, value in ms on the first input.

[†]Actual measured period, value in ms on the second input.

[‡]Actual measured period, value in ms on the third input.

Dig/Ana/Freq Opt IX(CMD 73)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and has to be activated if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x49	Per 3[*] (LSB)	Per 3[*] (MSB)	Per 4[†] (LSB)	Per 4[†] (MSB)	Per 5[‡] (LSB)	Per 5[‡] (MSB)	——	0 ms	DIG_ANA_FREQ_OPTIX

[*]Actual measured period, value in ms on the fourth input.

[†]Actual measured period, value in ms on the fifth input.

[‡]Actual measured period, value in ms on the sixth input.

Messages Based on the Sub-Identifier

Dig/Ana/Freq Opt X(CMD 74)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and has to be activated if the device does have these inputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x4A	Per 6[*] (LSB)	Per 6[*] (MSB)	Per 7[†] (LSB)	Per 7[†] (MSB)	Per 8[‡] (LSB)	Per 8[‡] (MSB)	——	0ms	DIG_ANA_FREQ_OPTX

[*]Actual measured period, value in ms on the seventh input

[†]Actual measured period, value in ms on the eighth input

[‡]Actual measured period, value in ms on the ninth input

Digital Out Status (CMD 80)

This frame is transmitted from the I/O device continuously with a default cycle time. This message will only be transmitted if the device does have this type of output. This message has to be activated; by default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x50	Channel[*]	DigOutStat[†]	——	——	——	——	——	0 ms	DIG_OUT_STAT

[*]Identifies the channel.

[†]Status of the digital output.

Digital/PVG Out Status (CMD 81)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x51	Channel[*]	Value[†] (LSB)	Value[†] (LSB)	PvgOut_Stat[‡]	——	——	——	0 ms	PVG_STAT

[*]Identifies the channel.

[†]Actual measured value in mV.

[‡]Status of the digital output.

Digital/PVG Out Status Opt I (CMD 82)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x52	Value 0[*] (LSB)	Value 0[*] (MSB)	Value 1[†] (LSB)	Value 1[†] (MSB)	Value 2[‡] (LSB)	Value 2[‡] (MSB)	DigOut_Stat 0_5[§]	20 ms	PVG_STAT_OPTI

[*]Identifies the channel.

[†]Actual measured value of first PVG channel in mV.

[†]Actual measured value of second PVG channel in mV.

[‡]Actual measured value of third PVG channel in mV.

[§]Status of the digital output of digital and PVG outputs; bit 0 = digital channel 0.

Multifunction Out Status (CMD 96)

This frame is transmitted from the I/O device continuously with a default cycle time. This message will only be transmitted if the device does have this type of output. This message has to be activated; by default the packed frames are used.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x60	Channel[*]	Value[†] (LSB)	Value[†] (MSB)	ActPWM[‡] (LSB)	ActPWM[‡] (MSB)	Status[§]	——	0 ms	MF_OUT

[*]Indicates the channel.

[†]Actual measured feedback value in 0.1 mA.

[‡]PWM duty cycle.

[§]Status of the output.

Multifunction Out Status Opt I (CMD 97)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x61	Value 0[*] (LSB)	Value 0[*] (MSB)	Value 1[†] (LSB)	Value 1[†] (MSB)	Value 2[‡] (LSB)	Value 2[‡] (MSB)	Status[§]	20 ms	MF_OUT_OPTI

[*]Actual measured feedback value of channel 0 in 0.1 mA.

[†]Actual measured feedback value of channel 1 in 0.1 mA.

[‡]Actual measured feedback value of channel 2 in 0.1 mA.

[§]Status of the output; Status of channel 0 is bit 0 and bit 1, status of channel 1 is bit 2 and bit 3, status of channel 3 is bit 4 and bit 5.

Multifunction Out Status Opt II (CMD 98)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x62	Value 3[*] (LSB)	Value 3[*] (MSB)	Value 4[†] (LSB)	Value 4[†] (MSB)	Value 5[‡] (LSB)	Value 5[‡] (MSB)	Status[§]	20 ms	MF_OUT_OPTII

[*]Actual measured feedback value of channel 3 in 0.1 mA.

[†]Actual measured feedback value of channel 4 in 0.1 mA.

[‡]Actual measured feedback value of channel 5 in 0.1 mA.

[§]Status of the output; Status of channel 3 is bit 0 and bit 1, channel 4 bit 2 and bit 3, channel 5 bit 4 and bit 5.

Multifunction Out Status Opt OPT III (CMD 99)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x63	Value 6[*] (LSB)	Value 6[*] (MSB)	Value 7[†] (LSB)	Value 7[†] (MSB)	Value 8[‡] (LSB)	Value 8[‡] (MSB)	Status[§]	20 ms	MF_OUT_OPTIII

[*]Actual measured feedback value of channel 6 in 0.1 mA.

[†]Actual measured feedback value of channel 7 in 0.1 mA.

[§]Status of the output; Status of channel 6 is bit 0 and bit 1, channel 7 bit 2 and bit 3, channel 8 bit 4 and bit 5.

Multifunction Out Status Opt IV (CMD 100)

This frame is transmitted from the I/O device continuously with a default cycle time. This message is a packed frame and is activated by default if the device does have these outputs. Values not available on the I/O device will be set to zero.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Rate	Name
0x64	Value 9[*] (LSB)	Value 9[*] (MSB)	Value 10[†] (LSB)	Value 10[†] (MSB)	Value 11[‡] (LSB)	Value 11[‡] (MSB)	Status[§]	20 ms	MF_OUT_OPTIV

[*] Actual measured feedback value of channel 9 in 0.1 mA.

[†]Actual measured feedback value of channel 10 in 0.1 mA.

[‡]Actual measured feedback value of channel 11 in 0.1 mA.

[§]Status of the output; Status of channel 9 is bit 0 and bit 1, channel 10 bit 2 and bit 3, channel 11 bit 4 and bit 5.

Digital Out (CMD 128)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. DIGOUT is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x80	Channel*	DigOut†	——	——	——	——	——	0 ms	DIG_OUT_REQ

*Identifies the channel.

†Requested output state.

Digital/PVG Out (CMD 129)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. DIGOUT is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x81	Channel*	PVGOut†	——	——	——	——	——	0 ms	PVG_REQ

*Identifies the channel.

†Requested output state.

Digital/PVG Out Opt I (CMD 130)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. DIGOUT is interpreted as False for a corresponding bit of zero and True for a corresponding bit of one.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x82	DigOut 0_7*	DigOut 8_15†	PVGOut 0_7‡	PVGOut 8_15§	——	——	——	100 ms	DIGPVG_OPT1

*Requested state for DIGOUT 0 to 7; Channel 0 is bit 0.

†Requested state for DIGOUT 8 to 15; Channel 8 is bit 0.

‡Requested state for PVGOUT 0 to 7; Channel 0 is bit 0.

§Requested state for DIGOUT 8 to 15; Channel 8 is bit 0.

Multifunction Out (CMD 144)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. OUTPUT is interpreted based on the pin configuration. Please see the corresponding device API for more details of proper values. If configured as a digital output is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x90	Channel*	Output† (LSB)	Output† (MSB)	——	——	——	——	0 ms	MF_OUT_REQ

*Identifies the channel.

†Requested state.

Multifunction Out Opt I (CMD 145)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. OUTPUT is interpreted based on the pin configuration. Please see the corresponding device API for more details of proper values. If configured as a digital output is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x91	Output 0* (LSB)	Output 0* (MSB)	Output 1† (LSB)	Output 1† (MSB)	Output 2‡ (LSB)	Output 2‡ (MSB)	——	100 ms	MF_OUT_REQ_OPTI

*Requested output for channel 0.

†Requested output for channel 1.

‡Requested output for channel 2.

Multifunction Out Opt II (CMD 146)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. OUTPUT is interpreted based on the pin configuration. Please see the corresponding device API for more details of proper values. If configured as a digital output is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x92	Output 3* (LSB)	Output 3* (MSB)	Output 4† (LSB)	Output 4† (MSB)	Output 5‡ (LSB)	Output 5‡ (MSB)	——	100 ms	MF_OUT_REQ_OPTII

*Requested output for channel 3.

†Requested output for channel 4.

‡Requested output for channel 5.

Multifunction Out Opt III (CMD 147)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. OUTPUT is interpreted based on the pin configuration. Please see the corresponding device API for more details of proper values. If configured as a digital output is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x93	Output 6[*] (LSB)	Output 6[*] (MSB)	Output 7[†] (LSB)	Output 7[†] (MSB)	Output 8[‡] (LSB)	Output 8[‡] (MSB)	——	100 ms	MF_OUT_REQ_OPTIII

[*]Requested output for channel 6.

[†]Requested output for channel 7.

[‡]Requested output for channel 8.

Multifunction Out Opt IV (CMD 148)

This frame is transmitted to the I/O device continuously with a default cycle time. If the message does not arrive in the predefined cycle time, the slave will set the output to a default value. The default value and the timeout time can be defined. For more information see *Configure Timing (SUBCMD 12)* and *Configure Output Default (SUBCMD 13)* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029). If no default values have been defined, the shown timeout value will be used. If no default output value is defined, the I/O slaves will use a zero as a default value. This message will be interpreted from the slave in packed and unpacked data transmission mode. Commands for non-existing outputs will be ignored. OUTPUT is interpreted based on the pin configuration. Please see the corresponding device API for more details of proper values. If configured as a digital output is interpreted as False for a value of zero and True for all other values.

CMD CAN B 0	Data 0 CAN B 1	Data 1 CAN B 2	Data 2 CAN B 3	Data 3 CAN B 4	Data 4 CAN B 5	Data 5 CAN B 6	Data 6 CAN B 7	Timeout	Name
0x94	Output 9[*] (LSB)	Output 9[*] (MSB)	Output 10[†] (LSB)	Output 10[†] (MSB)	Output 11[‡] (LSB)	Output 11[‡] (MSB)	——	100 ms	MF_OUT_REQ_OPTIV

[*]Requested output for channel 9.

[†]Requested output for channel 10.

[‡]Requested output for channel 11.

Messages Based on the Sub-Command

Time uncritical messages are mapped to the subcommand messages. This area is entered by using 0xFF for the main CMD page. This means that 0xFF will be in the first data byte of the CAN-Message.

Ack (SUBCMD 0)

This frame is transmitted from the I/O device after reception of one of the CMD messages. It can be used for further diagnostics.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x00	Error*	Req Subcmd†	No‡	——	——	——	None	ACK

*Possible error information: 0 = no error; 1 = wrong index; 2 = function not supported.

†Gives information to which the ACK corresponds.

‡This is the N0 from the requestor.

Request Protocol Version (SUBCMD 1)

This frame can be transmitted from the MC to ask for the protocol version.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x01	——	——	——	——	——	——	None	REQ_PROT

Protocol Version (SUBCMD 2)

This frame is transmitted from the slave after reception of a REQ_PROT message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x02	Ver* (LSB)	Ver* (MSB)	UnitL† (LSB)	UnitL† (MSB)	UnitH† (LSB)	UnitH† (MSB)	None	PROT_VER

*Version of the communication protocol.

†Unit ID (high, low) number that describes the type of IO hardware

Configure DIG Input (SUBCMD 3)

This frame configures the digital inputs of an input device. All inputs are by default configured as no pull up/no pull down. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x03	Channel*	Config†	——	——	——	——	None	CMD_CONF_DIGIN

*Identifies the channel.

†Requested configuration.

Configure Analogue Input (SUBCMD 4)

This frame configures the analogue inputs of an input device. All inputs are by default configured as analogue inputs. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x04	Channel[*]	Config[†]	——	——	——	——	None	CMD_CONF_ANIN

[*]Identifies the channel.

[†]Requested configuration as specified in the corresponding Application Interface.

Configure Multifunction Input Dig/Ana (SUBCMD 5)

This frame configures the digital/analogue inputs of an input device. All inputs are by default configured as no pull up/no pull down and with the 5.250 V range. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x05	Channel[*]	Config 0[†]	Config 1[‡]	——	——	——	None	CMD_CONF_DIGANIN

[*]Indentifies the channel to configure.

[†]Requested configuration as specified in the corresponding Application Interface for the biasing.

[‡]Requested configuration as specified in the corresponding Application Interface for the voltage range.

Configure Multifunction Input Dig/Ana Switch Point (SUBCMD 6)

This frame configures the digital input switch point. Default for the low value is 2000. Default for the high value is 3000. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x06	Channel[*]	Low[†] (LSB)	Low[†] (MSB)	High[‡] (LSB)	High[‡] (MSB)	——	None	CMD_CONF_DIGANIN_SWITCH

[*]Indentifies the channel to configure.

[†]Requested low switch point as specified in the corresponding Application Interface.

[‡]Requested high switch point as specified in the corresponding Application Interface.

Configure Multifunction Input Dig/Ana/Freq (SUBCMD 7)

This frame configures the digital/analogue inputs of an input device. All inputs are by default configured as no pull up/ no pull down and with the 5.250 V range. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x07	Channel*	Config 0†	Config 1‡	——	——	——	None	CMD_CONF_DIGANFREQIN

*Indicates the channel to configure.

†Requested configuration as specified in the corresponding Application Interface for the biasing.

‡Requested configuration as specified in the corresponding Application Interface for the voltage range.

Configure Multifunction Input Dig/Ana/Freq Switch Point (SUBCMD 8)

This frame configures the digital input switch point. The default for low value is 2000. The default for the high value is 3000. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x08	Channel*	Low†(LSB)	Low† (MSB)	High‡ LSB	High‡ (MSB)	——	None	CMD_CONF_DIGANFREQIN_SWITCH

*Indicates the channel to configure.

†Requested low switch point as specified in the corresponding Application Interface.

‡Requested high switch point as specified in the corresponding Application Interface.

Configure Multifunction Output (SUBCMD 9)

This frame configures the multifunction output of an output device.

All outputs are by default configured as:

•   Digital Output (push/pull).

•   Dither Freq = 0.

•   Dither Amp = 0.

The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x09	Channel*	Config†	D_Freq‡ (LSB)	D_Freq‡ (MSB)	D_Amp§ (LSB)	D_Amp§ (MSB)	None	CMD_CONF_MF_OUT

*Indicates the channel to configure.

†Requested configuration as specified in the corresponding Application Interface.

‡Requested value for dither frequency.

§Requested value for dither amplitude.

Configure Multifunction Output Frequency (SUBCMD 10)

This frame configures the PWM frequency of a set of outputs. Default is 4000. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0A	Channel[*]	Freq[†] (LSB)	Freq[†] (MSB)	——	——	——	None	CMD_CONF_MF_OUT_FREQ

[*]Indicates the group to configure.

[†]Requested output frequency; if it is out of range, the device will select the nearest possible.

Freeze N1 (SUBCMD 11)

On reception of this frame the I/O device will rescan the analogue input and will calculate N1 and save this parameter. The I/O device will also change to predefined CAN-identifier mode with fixed N1. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0B	——	——	——	——	——	——	None	CMD_FREEZE_N1

Configure Timing (SUBCMD 12)

This frame can be used to configure the timing of the cyclic transmit messages of the I/O slave. It can also be used to set new values for the cyclic receive messages of the I/O slave. The I/O device responds with the ACK message. A value of 0x0000 for time totally disables a message transmitted from the I/O slave. Otherwise, the time value is entered in milliseconds.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0C	Sub-identifier[*]	Channel[†]	Time[‡] (LSB)	Time[‡] (MSB)	——	——	None	CMD_TIME

[†]If the message being enabled or disabled has a "channel" value associated with it, please enter the value here.

[*]Identifies the communication message gets a new timing value.

[‡]New timing value, which can be the new cycle or the new timeout value, depending on the message.

Configure Output Default (SUBCMD 13)

This frame can be used to configure the default output values of the output slaves. After start up these values are set to zero. These default values will be used if a timeout occurs on the cyclic CMD messages. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0D	Output Type*	Channel†	Value‡ (LSB)	Value‡ (MSB)	——	——	None	CMD_OUT_DEFAULT

*The output type:

– 0 = Digital output.

– 1 = PVG power output.

– 2 = Multifunction output.

†The channel on which the new default value has to be set.

The new default value used in case the communication breaks down.

Set AddrMode (SUBCMD 14)

This frame sets the CAN-ID mode with N1 and MASK and the baud rate for the I/O device. The I/O device responses with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0E	AddrMode*	N1†	Mask‡	Baud§ 0_7	Baud§ 8_15	Baud§ 16_23	None	CMD_ADDR_MODE

*Sets the addressing mode; ignored if 0xFF.

†N1 to set; ignored if 0xFF otherwise only the last four significant bits will be used.

‡Mask value to set; ignored if 0xFF otherwise only the three least significant bits are used.

§The requested power up baud rate, ignored if 0xFFffff.

Set Fixed Tx ID (SUBCMD 15)

This frame sets a fixed Tx ID. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x0F	Tx* LW (LSB)	Tx* LW (MSB)	Tx* HW (LSB)	Tx* HW (MSB)	Frame†	——	None	CMD_FIX_Tx _ID

*ID for the Tx message of the fixed CAN-ID.

†Defines if 11 bit or 29 bit identifiers should be used, 0 = 11 bit and 1 = 29 bit ID.

Set Fixed Rx ID (SUBCMD 16)

This frame sets a fixed Rx ID. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x10	Rx* LW (LSB)	Rx* LW (MSB)	Rx* HW (LSB)	Rx* HW (MSB)	——	——	None	CMD_FIX_Rx _ID

*ID for the Rx message of the fixed CAN-ID, it will use the same frame type as for the Tx message.

Set KWP2000 Net (SUBCMD 17)

This frame sets the Net Number for Keyword Protocol 2000. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x11	Net*	——	——	——	——	——	None	CMD_NET_NMB

*Value for the KWP NET number.

Configuration CRC (SUBCMD 18)

This message contains the Configuration CRC number out of an I/O device in response to a request using SUBCMD 255.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x12	CRC* (LSB)	CRC* (MSB)	CRC Mode†	CRC Param‡	——	——	None	CMD_GET_CRC

*U16 configuration CRC number.

†Optional value; if not existing or if zero, then the CRC value is over parameters from protocol version 2.00 and the parameter CRC Param has no effect.

‡If CRC Mode = 1 this value describes over which range the CRC is calculated. 0 = Parameters from version 2.00; 1 = All parameters as defined by version 2.01 including earlier versions.

Temporary IO Configuration (SUBCMD 19)

This frame can be used to configure the configuration of IOs. This configuration is lost after power cycle. After start up these values are set to the default values. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x13	IO_Type*	Channel†	Value 0‡	Value 1§	——	——	None	CMD_CONF_TEMP

*Input/output type:

– 0 = Digital output.
– 1 = PVG power output.
– 2 = Multifunction output.
– 3 = Analogue input.
– 4 = Digital/analogue input.
– 5 = Multifunction input.
– 6 = Digital input.

†The channel on which the new configuration value has to be set.

‡The new configuration value 0.

§The new configuration value 1.

Configure Current Change Limit (SUBCMD 20)

This frame configures the current change limit of a multifunction output of an output device. The default value is 111. The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x14	Channel*	Limit† (LSB)	Limit† (MSB)	——	——	——	None	CMD_CONF_CURCHGLIM

*Identifies the channel to configure.

†Requested current change limit as specified in the corresponding Application Interface.

Configure Recover Times (SUBCMD 21)

This frame configures the bus off and can driver recover time. The default value for both parameters is 10000, which means in case of a recovery situation the device will try to recover every 10 seconds.

The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x15	Channel*	Bus† (LSB)	Bus† (MSB)	Driver‡ (LSB)	Driver‡ (MSB)	——	None	CMD_CONF_RCVR_TIME

*Identifies the channel to configure.

†Requested time value for Bus OFF recover in ms.

‡Requested time value for CAN driver recover in ms.

Non-Volatile Memory Storage (SUBCMD 22)

This frame allows access to the data storage provided by the expansion module. Data can be written to 16 individual 32-bit memory segments. Each 32-bit segment allows the storage of an 8-bit checksum in addition to the 32-bit data, this allows validity checks. The 8-bit checksum will be handled by the master device, not the expansion module. This allows the master to implement it's own checksum algorithm.

Data loss will occur if a power failure occurs during a write to a 32-bit memory segment.

Maximum number of writes: 10,000

The I/O device responds with the ACK message.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0x16	8-bit segment address*	8-bit checksum†	32-bit data‡	32-bit data‡	32-bit data‡	32-bit data‡	None	CMD_DATA_STORAGE

*The lower 4-bits of DATA 0 are used to select which 32-bit segment will be written (0-15).

†8-bit field to allow the master to write a checksum for data validation.

‡32-bit data segment for storage.

Request Configuration (SUBCMD 255)

This frame can be used to request the configuration state of a certain input or output. In addition, the configuration of the messages can be requested with this frame. The I/O device responds with the corresponding configuration message in a positive case else with an ACK message containing the error.

CMD CAN B 0	SUBCMD CAN B 1	Data 0 CAN B 2	Data 1 CAN B 3	Data 2 CAN B 4	Data 3 CAN B 5	Data 4 CAN B 6	Data 5 CAN B 7	Timeout	Name
0xFF	0xFF	Configuration Type[*]	Channel[†] or CRC Mode[‡]	CRC Param[§]	——	——	——	None	CMD_REQ_CONF

[*]See the following *Configuration Type Definition* table.

[†]The channel from which the information is requested.

[‡]If zero, the CRC value is over parameters from protocol version 2.00 and the parameter CRC Param has no effect.

[§]Optional value—ff CRC Mode = 1 this value describes the range over which the CRC is calculated. 0 = Parameters from version 2.00; 1 = All parameters as defined by version 2.01 including earlier versions.

Configuration Type Definition

Configuration Type Value	Type of Configurable Input/Output	Positive Response Message of the Slave
0	Digital input	Configure dig input (SUBCMD 3)
1	Analogue input	Configure analogue input (SUBCMD 4)
2	Multifunction input Dig/Ana	Configure multifunction input Dig/Ana (SUBCMD 5)
3	Multifunction input Dig/Ana switch point	Configure multifunction input Dig/Ana switch point (SUBCMD 6)
4	Multifunction input Dig/Ana/Freq	Configure multifunction input Dig/Ana/Freq (SUBCMD 7)
5	Multifunction input Dig/Ana/Freq switch point	Configure multifunction input Dig/Ana/Freq switch point (SUBCMD8)
6	Multifunction output	Configure multifunction output (SUBCMD 9)
7	Multifunction output frequency	Configure multifunction output frequency (SUBCMD 10)
8	Timing	Configure timing (SUBCMD 12)
9	Output defaults	Configure output default (SUBCMD 13)
10	Set AddrMode	Set AddrMode (SUBCMD 14)
11	Set Tx	Set fixed Tx ID (SUBCMD 15)
12	Set Rx	Set fixed Rx ID (SUBCMD 16)
13	Set KWP NET number	Set KWP2000 NET (SUBCMD 17)
14	Configuration CRC	Configuration CRC (SUBCMD 18)
15	Current change limit	Configure current change limit (SUBCMD 20)
16	Recover time	Configure recover times (SUBCMD 21)
17	Non-volatile memory storage	Non-volatile memory storage (SUBCMD 22)

Several parameters of the system have to be stored in the non-volatile memory so that the parameters are available after a power cycle. These parameters can always be accessed and modified with the diagnostic tool. Besides communication parameters some predefined start up values for the outputs and the configuration values for the outputs and the inputs are stored in the non volatile memory.

Parameter Overview

Parameter	Data Type	Default Value	Range	Protocol Version
PwrUpBaud	U32	250 000	1 000 000 500 000 250 000 125 000 100 000	2.00
AddrMode	U16	0	0 = Variable ID 1= Predefined ID fixed N1 2 = Fixed ID	2.00
Tx	U32	0x400	0x00–0x1FFFFFFF	2.00
Rx	U32	0x500	0x00–0x1FFFFFFF	2.00
Frame	U16	0	0 = 11 bid ID 1= 29 bit ID	2.00
N1	U16	0	0–15	2.00
Mask	U16	0	0–7	2.00
Net	U16	0	0–255	2.00
Out Default [NMBChannel]	U16	0	0xFFFF	2.00
Out Default Config [NMBChannel]	U16	0	0xFFFF	2.00
DigOut Default [NMBChannel]	U16	0	0xFFFF	2.00
PVE Default [NMBChannel]	U16	0	0xFFFF	2.00
Digital Default Config [NMBChannel]	U16	0	0xFFFF	2.00
In Default Config 0 [NMBChannel]	U16	0	0xFFFF	2.00
In Default Config 1 [NMBChannel]	U16	0	0xFFFF	2.00
Rheo Default Config [NMBChannel]	U16	0	0xFFFF	2.00
Digital Anin Default Config 0 [NMBChannel]	U16	0	0xFFFF	2.00
Digital Anin Default Config 1 [NMBChannel]	U16	0	0xFFFF	2.00
Bus Off Error Rcvr Time [NMBChannel]	U16	0x2710	0xFFFF	2.01
CAN Drv Error Rcvr Time [NMBChannel]	U16	0x2710	0xFFFF	2.01

Power-Up Baud Rate (PwrUpBaud) Parameter

This parameter defines the power up baud rate of the device. The I/O device will initialize the CAN-Bus with the baud rate given by this parameter after power up. Changing this parameter will take affect only after the next power cycle.

Addressing Mode (AddrMode) Parameter

The addressing mode selects one of the following:

- Variable CAN-Identifiers based on the CAN-Shield input

- Predefined CAN-Identifiers with fixed N1

- Fixed identifiers

For more information, refer to *CAN-Identifier Usage* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029).

Fixed Tx ID (Tx) Parameter

This parameter is only used in the case of fixed identifier addressing mode and describes the ID for the Tx message of the device.

For more information, refer to *Fixed Identifier Usage* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029).

Fixed Rx ID (Rx) Parameter

This parameter is only used in the case of fixed identifier addressing mode and describes the ID for the Rx message of the device.

For more information, refer to *Fixed Identifier Usage* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029).

Fixed ID Frame Format (Frame) Parameter

This parameter is only used in the case of fixed identifier addressing mode and describes the message frame format (11-bit or 29 bit identifier.)

For more information, refer to *Fixed Identifier Usage* in the *PLUS+1 CAN I/O Module Communications Technical Information* document (Sauer-Danfoss part 520L1029).

N1 (N1) Parameter

This parameter is only used in the case of predefined CAN-Identifier addressing mode and contains the value for N1.

Mask (Mask) Parameter

This parameter contains the mask for the CAN-Messages being received. It is used to set the mask of the receiving CAN-Mailbox. This parameter applies to all addressing modes. A value of 1 means don't care for the corresponding bit position.

KWP2000 Net Number (Net) Parameter

This parameter contains the power up KWP2000 net number.

Default Output Value (Out Default) Parameter

This parameter contains the default output value for the multifunction outputs. There are as many default values as the unit has outputs. This default value will be used, if the corresponding CAN-Frame has a timeout.

Default Output Configuration (Out Default Config) Parameter

This parameter contains the default output configuration value. There are as many default values as the unit has outputs. This default value will be used at start up of the unit.

Default DigOut Value (DigOut Default) Parameter

This parameter contains the default output value for the digital outputs. There are as many default values as the unit does have these outputs. This default value will be used if the corresponding CAN-Frame has a timeout.

Default PVE Value (PVE Default) Parameter

This parameter contains the default output value for the PVE power outputs. There are as many default values as the unit has outputs. This default value will be used if the corresponding CAN-Frame has a timeout.

Digital Input Configuration (DigitalDefault Config) Parameter

This parameter contains the default configuration value for the biasing of the digital inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Input Configuration 0 (In Default Config 0) Parameter

This parameter contains the default configuration value for the biasing of the multifunction inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Input Configuration 1 (In Default Config 1) Parameter

This parameter contains the default configuration value for the voltage divider of the multifunction inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Digital Analogue Input Configuration 0 (Digital AnIn Default Config 0) Parameter

This parameter contains the default configuration value for the biasing of the digital/analogue inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Digital Analogue Input Configuration 1 (Digital AnIn Default Config 1) Parameter

This parameter contains the default configuration value for the voltage divider of the digital/analogue inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Rheostat Input Configuration 1 (Rheo Default Config 1) Parameter

This parameter contains the default configuration value for mode switching between analogue and rheostat measurement for the rheostat inputs. There are as many default values as the unit has inputs. This default value will be used at start up of the unit.

Bus OFF Recover Time (Bus Off Rcvr Rate) Parameter

This parameter contains the default time value for the CAN Bus OFF recover time in ms. The unit will try to recover from the Bus off condition until it succeeds. The time between two attempts is given by this value. There are as many recover times as the unit has CAN channels.

CAN Driver Error Recover time (CAN Drv Error Rcvr Time) Parameter

This parameter contains the default time value for the CAN driver error recover time in ms. The unit will try to recover from the CAN driver error condition until it succeeds. The time between two attempts is given by this value. There are as many recover times as the unit has CAN channels.

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