CSR 021

The CSR 021 is a C-DIAS module designed to control a DC motor up to a maximum of 3.5 A and 30 V for the S3 / 50% operation mode (intermittent operation 50%) and a maximum duty cycle of 1.5 minutes. For regulation of the motor, 3 digital inputs and an incremental encoder input (TTL and RS42 signal) are provided. The module also has two controllable LED outputs (8-bit) with 20 and 350 mA output currents.
The module shows the motor current with a 10-bit resolution.

Technical Data

Motor output

Number of outputs	1
Supply voltage	12 - 30 V DC
Current	0 – 3.5 A
Operation mode	S3 / 50 % (intermittent 50 %) with a maximum duty cycle of 1.5 min
Motor peak start current	Up to 10 A
Current measurement	10 Bits (depending on the motor)
Status display	1 x LED (green)

Incremental encoder input

Number of channels	1
Input signals	Incremental encoder signals RS422 (A, /A, B, /B, R, /R) RS422 signal (120 Ω termination) Incremental encoder signal TTL (A, B, R) TTL level (3300 Ω Pull-Up)
Input frequency	Maximum 125 kHz
Counter frequency	Maximum 500 kHz
Signal evaluation	4X
Counter resolution	16 bits
Encoder power supply	+5 V / 0,2 A short circuit protected

Digital Inputs

Number of outputs	3	
Input voltage	Typically 24 V	Maximum +30 V
Signal level	Low: <+5.3 V	High: >+13.7 V
Switching threshold	Typically 11 V	
Input current	5 V / 24 V	
Input delay	Typically 5 ms	
Status display	3 x LED (green)	

Current outputs

Number of outputs	2
Power LED	0 - 350 mA
Resolution	8-bit
White LED	0 - 20 mA
Resolution	8-bit

Electrical requirements

Power supply +24V	18 – 30 V	
Current consumption of +24 V power supply	Maximum 210 mA / 24 V	
Motor supply	12 – 30 V	
Current consumption of motor supply	Depends on the motor	
Power supply from C-DIAS bus	+5 V	
Current consumption of C-DIAS bus (+5 V supply)	Typically 100 mA	Maximum 130 mA
Power supply from C-DIAS bus	+24 V	
Current consumption of C-DIAS bus (+24 V supply)	Typically 50 mA	Maximum 80 mA

IMPORTANT:
The motor current should not exceed the defined value of 3.5 A; this also applies to braking and start-up of the motor. The module can regulate the peak start current of the motor for only a short time. The current cannot flow longer 1ms and can only be applied once per second (duty cycle 1:1000).

When braking, the motor functions like a generator and feeds voltage back to the power supply system; this voltage cannot exceed 40 V.

If the voltage or current is exceeded, the CSR 021 module is out of its specifications.

CAUTION:
Due to the internal construction, high start current spikes can be generated with activation of the motor voltage supply that can lead to increased wear on switch contacts. Measures may have to be taken to limit the start current as required.

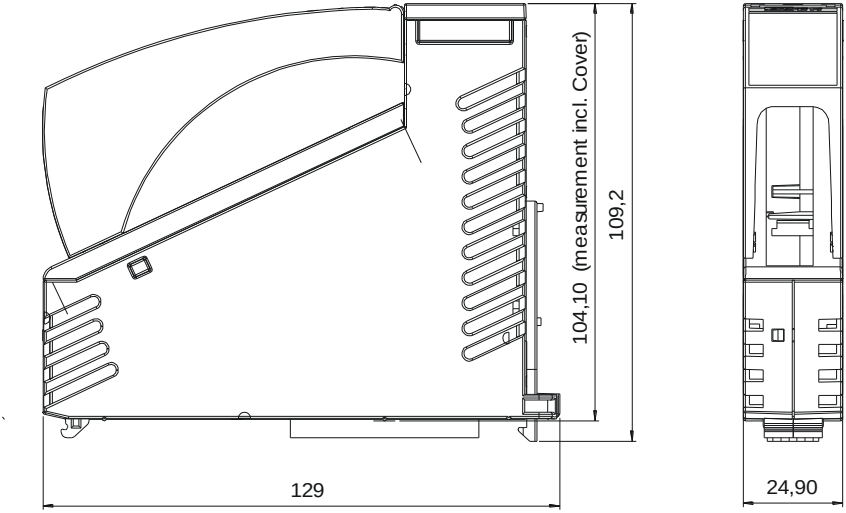
Miscellaneous

Article number	12-029-021
Hardware version	1.x

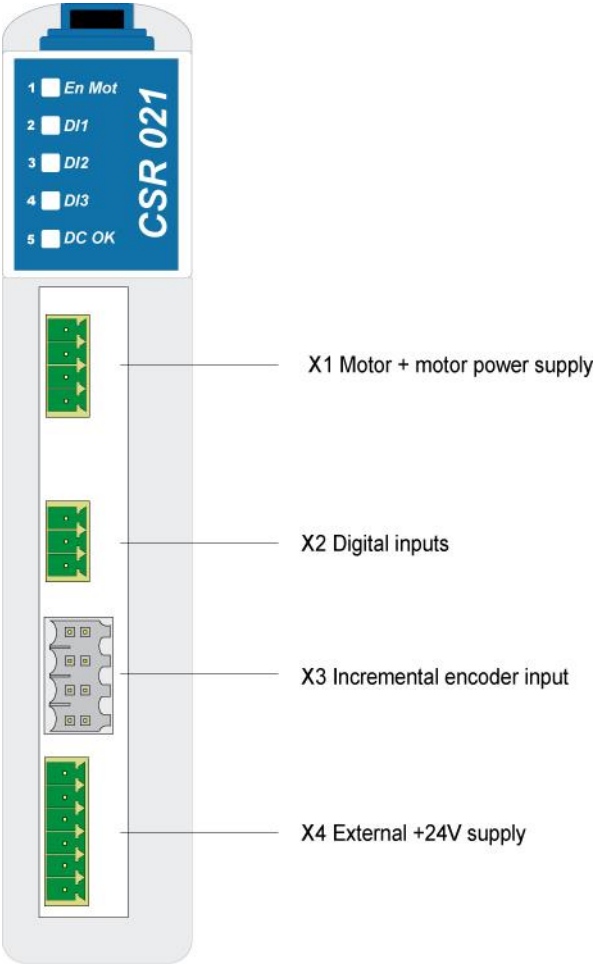
Environmental conditions

Storage temperature	-20 – +85 °C	
Operating temperature	0 – +60 °C	
Humidity	0 - 95 %, uncondensed	
EMV stability	According to EN 61000-6-2:2001 (industrial area)	
Shock resistance	EN 60068-2-27	150 m/s²
Protection Type	EN 60529	IP 20

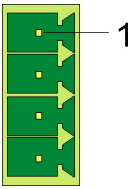
Mechanical Dimensions



Connector Layout

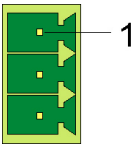


X1: Motor + Motor power supply



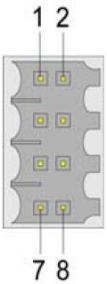
Pin	Function
1	Motor +
2	Motor -
3	12 – 30 V
4	GND

X2: Digital inputs



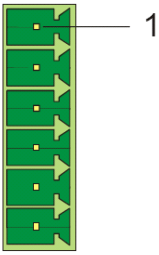
Pin	Function
1	Digital Input 1
2	Digital Input 2
3	Digital Input 3

X3: Incremental encoder input



Pin	Function
1	A- (RS422)
2	A+ (RS422 and TTL)
3	B- (RS422)
4	B+ (RS422 and TTL)
5	R- (RS422)
6	R+ (RS422 and TTL)
7	GND
8	+5 V-encoder

X4: Current outputs + module supply



Pin	Function
1	20 mA anode
2	20 mA cathode
3	350 mA anode
4	350 mA cathode
5	+24 V (18 – 30 V)
6	GND

Applicable connectors

X1: 4-pin Phoenix RM3,5 FK-MCP 1,5/4-ST-3,5
X2: 3-pin Phoenix RM3,5 FK-MCP 1,5/3-ST-3,5
X3: 8-pin Weidmüller socket terminal B2L/B2CF 3,5/8 RM3,5
X4: 6-pin Phoenix RM3,5 FK-MCP 1,5/6-ST-3,5

The complete C-DIAS CKL 151 connector set with spring terminals is available from SIGMATEK under the article number 12-600-151.

Status display

LED-Nr.	LED color	Definition
1	Green	Motor controller release
2	Green	Digital Input 1
3	Green	Digital Input 2
4	Green	Digital Input 3
5	Green	External power supply connected

General

Wiring Guidelines

To ensure error-free operation, a careful wiring method must be followed.

The 0 V connection of the supply voltage must be connected with the 0 V collection point over the shortest route possible.

The signal lines should be shielded or at least twisted pair wires.

User Instructions

The motor's peak current can be limited through slow braking and starting of the motor (ramping). This ramp should be adjusted to the motor.
The current can also be limited with an inductive network wired into the motor circuits. This would however negatively affect the precision of the motor's positioning.

The motor voltage supplied to the system can be limited with a suppressor diode. With this variation, the power drop over the diode should be taken into consideration:
Another option would be to use an additional load parallel to the motor. For example, the voltage returned the power supply could be used by a resistor.

Mounting

With the application of high currents, the module heats quickly. Optimal heat dissipation is ensured through the correct mounting.
Forced convection is also possible with the use of a fan; in this case, the mounting position does not matter.

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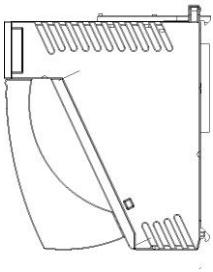

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Addressing

Address (hex)	Size (Byte)	Access Type:	Description	Reset value (hex)
			Sequencer	
0000	2	r16/ w16	Sequence 1 data. 16 bit values bit 0..10 : time value / clock frequency bit 11 : 1 = take absolute time counter 0 = take relative time counter bit 12 : left high bit 13 : right high bit 14 : left low bit 15 : right low	0000
0002	2	r16/ w16	Sequence 2 data. 16 bit values bit 0..10 : time value / clock frequency bit 11 : 1 = take absolute time counter 0 = take relative time counter bit 12 : left high bit 13 : right high bit 14 : left low bit 15 : right low	0000
0004	2	r16/ w16	Sequence 3 data. 16 bit values bit 0..10 : time value / clock frequency bit 11 : 1 = take absolute time counter 0 = take relative time counter bit 12 : left high bit 13 : right high bit 14 : left low bit 15 : right low	0000
0006	2	r16/ w16	Sequence 4 data. 16 bit values bit 0..10 : time value / clock frequency bit 11 : 1 = take absolute time counter 0 = take relative time counter bit 12 : left high bit 13 : right high bit 14 : left low bit 15 : right low	0000
0008	2	r16/ w16	Period time value / clock frequency	0000
000A	1	r/w	Control/Status Byte bit 0 : sequence enable bit 1 : reserved bit 2 : wrong sequence (forbidden setting of the output sequence Bits) bit 3 : absolute time error (the absolute time values must rise on each sequence) bit 4..7 : reserved	00
000B	1	r	clock frequency (Mhz)	20

			Motor bridge current	
000C	2	r16	10 bit adc value	0000
000E	2		Reserved	
			Incremental period counter	
0010	4	r32	Period counter 32 Bit signed value	00000000
0010	4	w32	Period counter level (31 bit)	7FFFFFFF
0014	2		Reserved	
0016	1	r/w	Period prescale register $\text{Period prescal} = \text{Clk(Hz)} * \text{measure time(sec)}$	04
0017	1	r	Clock Frequency Clock frequency in MHz	20
			Incremental encoder	
0018	2	r16	Incremental Encoder Counter The counter value represents the number of rising/falling incremental encoder edges. The counter value is incremented/decremented upon 1, 2 or 4 edges per pulse (selected by Byte 16#02/ Bit 4..5).	0000
001A	1	r/w	Incremental Encoder Command Register Bit 0..1: Reserved Bit 2: Zero Position input inversion (1 = inverted) Bit 3: Phase B inversion (1 = inverted) Bit 4..5: Edge sampling 0 = Incremental Encoder off 1 = 1 Edge 2 = 2 Edges 3 = 4 Edges Bit 6..7: Reserved	30
001B	1	r	Incremental Encoder Status Register Bit 0..3: Reserved Bit 4: Zero Position Bit 5: Zero Position latched Bit 6..7: Reserved	00
001C	2	r16	Incremental Encoder Counter latched This Register is the latched version of the Incremental Encoder Counter.	0000
001E	2		Reserved	

PWM for 20mA LED				
0020	2	r16	PWM prescale register Prescales the 32MHz input clock to 5,33MHz 5,33Mhz/ 256 (8 bit resolution) ≈ 20kHz PWM rate	0006
0022	2	r16	PWM Period Maximum value of the PWM counter	00FF
0024	1	r/w	PWM output on time	00
0025	1		Reserved	
0027	1	r/w	PWM status/control register Bit 0: PWM SW enable (1 = on / 0 = off) Bit 1: PWM HW enable (enable port) Bit 2 .. 7: reserved	03
0028	8		Reserved	
PWM for 350mA LED				
0030	2	r16	PWM prescale register Prescales the 32MHz input clock to ~ 914 kHz 914 kHz/ 256 (8 bit resolution) ≈ 3570 Hz PWM rate	0023
0032	2	r16	PWM Period Maximum value of the PWM counter	00FF
0034	1	r/w	PWM output on time	00
0035	1		Reserved	
0037	1	r/w	PWM status/control register Bit 0: PWM SW enable (1 = on / 0 = off) Bit 1: PWM HW enable (enable port) Bit 2 .. 7: reserved	03
0038	18		Reserved	
Digital I/O				
0050	1	r/w	Bit0: Bit6 reserved Bit7: incremental encoder assortment 0: TTL incremental encoder 1: RS 422 incremental encoder	00
0051	1	r	Bit0: Digital In 1 Bit1: Digital In 1 Bit2: Digital In 1 Bit3..7 reserved	
0052	2		Reserved	

			Status Rgister	
0054	1	r	Status register Bit0: High motor current Bit1: Motor current too high (additional periphery reset occurs) Bit2: Dc_ok (Extern Supply for Encoder, LEDs, Current measurement(OpAmp), see table Reset Signals) Bit3: Periphery Reset LED (see table Reset Signals) Bit4: Periphery Reset Motor (see table Reset Signals) Bit5: Induction voltage from motor to high (additional periphery reset occurs) Bit6..7: reserved	00
0055	1	r	Latched Status Register Bit0: High motor current Bit1: Motor current too high (additional periphery reset occurs) Bit2: Dc_ok (Extern Supply for Encoder, LEDs, Current measurement(OpAmp), see table Reset Signals) Bit3: Periphery Reset LED (see table Reset Signals) Bit4: Periphery Reset Motor (see table Reset Signals) Bit5: Induction voltage from motor to high (additional periphery reset occurs) Bit6..7: reserved	00
0056	1	r/w	Enable register rising edge detection Bit0: input 0; '1' = used as detection on rising edge for High Motor Current Bit1: input 1; '1' = used as detection on rising edge for Motor Current Too High Bit2: input 2; '1' = used as detection on rising edge for Dc_ok Bit3: input 3; '1' = used as detection on rising edge for Periphery Reset LED Bit4: input 4; '1' = used as detection on rising edge for Periphery Reset Motor Bit5: input 5; '1' = used as detection on rising edge for high induction voltage Bit6..7: reserved	1F
0057	1	r/w	Enable register falling edge detection Bit0: input 0; '1' = used as detection on falling edge for High Motor Current Bit1: input 1; '1' = used as detection on falling edge for Motor Current Too High Bit2: input 2; '1' = used as detection on falling edge for Dc_ok Bit3: input 3; '1' = used as detection on falling edge for Periphery Reset LED Bit4: input 4; '1' = used as detection on falling edge for Periphery Reset Motor Bit5: input 5; '1' = used as detection on falling edge for high induction voltage Bit6..7: reserved	00
0058	98		Reserved	

Period measure (Temperature Sensor)				
0060	2	r16	Period Temperature in K	0000
0062	2	r16/ w16	Prescale Register Scalar multiplier of temperature sensor	000A
0064	2	r16	High Time Register 50% of Period	0000
Address Space Extender				
00F0	4	r32/ w32	Address Space Extender SPI address register (more Information on SPI Master)	00000000
00F4	4	r32/ w32	Address Space Extender SPI data register	00000000
00F5	6		Reserved	
FPGA Version				
00FB	1	r	FPGA Version	20

CSR 021 calibration data (24C02 is organized by byte)

Address	Data	Description
$00	$xx	Check sum
$01	123	Identification
$02	32	Module group 32=CSR
$03	1	Module variant
$04	8	Number of channels
$05	10	**Hardware version $10=HW 1.0**
$06-$3F	0	FILL
$10		Serial number
		Calibration data PWM 0 – 20 mA, PWM 0 - 350 mA, motor current 0 - 4000 mA
$40	$xxxx	Check sum
$42	12345	Identification
$44	10	Length of the following data blocks in WORD
$46	3	Number of channels
$48	0	PWM20 Offset
$4A	231	PWM20 Multiplicand
$4C	255	PWM20 Divisor
$4E	0	PWM350 Offset (PT100)
$50	231	PWM350 Multiplicand (PT100)
$52	255	PWM350 Divisor (PT100)
$54	-512	Motor current offset
$56	4000	Motor current multiplicand
$58	419	Motor current divisor
$60-$FF	0	FILL