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EC – Controller Compacto Drives

Operating and installation instructions



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This Installation guide contains the information necessary for safety. Installation and basic running of the EC – Controller.

1. GENERAL SAFATEY



Danger!

Electric voltage on the device

EC-Drive must only be connected, instale, modified or repaired by a qualified person! Incorrect mounting could cause material damage and risk of fatal injury from electric shock! Domel is not responsible for any damage caused by incorrect or bad circuit connection or by non-professional installation!

Use fuses for power lines. Install all earth wires. Before operating check the wires for short circuits. Use only cables that meet the specified installation requirements for voltage, current, insulation material, load etc.



Warning!

Electric voltage!

Never open EC-Controller or parts of them when the main supply is connecting. It can be extremely dangerous and could cause risk of fatal injury from electric shock!

When is necessary to touch high voltages lines, disconnect the main supply voltage and wait at least 5 minutes before servicing the drive.



Note!

It is the responsibility of the user or installer to ensure correct grounding and protection in accordance with national and local standards.

1.1. Personal Safety

The **[Start / Stop]** input on the user interface panel of the EC drive does not disconnect the drive from the AC line. Do not use it as a safety switch.

Do not remove the terminal lines for the motor and AC line supply while the EC drive is connected to the AC line. Ensure that the AC line supply has been disconnected and wait 5 minutes before removing motor and AC lines.

The motor can be started by means of digital commands, bus commands, references or local start command whenever the drive is connected to the AC line. Therefore, an unintended start may occur anytime power is applied. Never service the drive or equipment when power is applied to the drive.

Before installing and operating EC-controller please read this instruction carefully!

1.2. Approvals, standards and certifications



General electromagnetic compatibility: EN-61800-3

Domel declares that the products are manufactured in accordance with Council Directive 92/31/EEC on electromagnetic compatibility (and subsequent amendments).

Domel guarantees that the controller will operating within the specifications, if all directions and recommendations are taken into consideration. Domel does not accept any responsibility for failures resulting from improper of use.

2. OPERATING MOUNTING AND THERMAL CONDITION

2.1. Operating and ambient condition

Protection level:.....	IP55
Vibration max:.....	0.7 g
Relative humidity:.....	5% - 90%
Operating temperature max:.....	+45°C without air flow
Operating temperature min:	-10°C

Storage & transport:

Temperature max:.....	+70°C
Temperature min:.....	-25°C
Relative humidity max.....	90%

2.2. General installation

Correct and precise mounting of the controller is required to provide reliable and carefree operation. The assembly should only be carried out by qualified persons, because proper mounting, cooling and sealing of controller is needed. Mounting is permitted only at prescribed places. All positions are allowed if conditions of solid attachment and adequate cooling are fulfilled (to prevent overheating of electronic).

2.2.1. Mounting and sealing

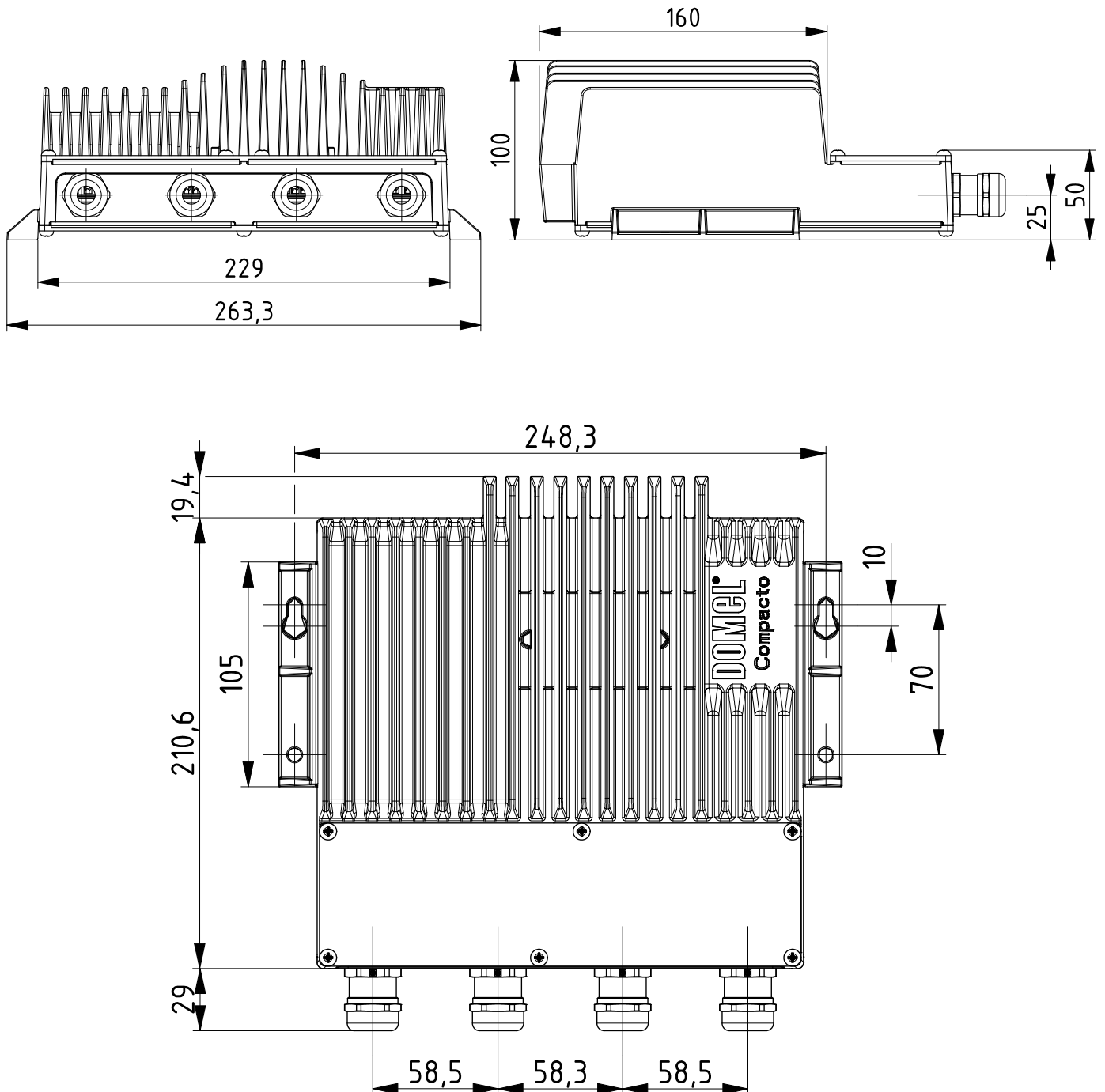
We recommended horizontal (on table) or vertical (on wall, with cable glands pointing down) attachment of the electronics. In horizontal installation we also recommend mounting on 2°-5° angle with glands pointing down, for lighter leaking of surface liquids. Suitable sealing for top cover and all glands should be provided at mounting (whether there are cables or not). Space between other objects in controller must be at least 20 mm (from the closest corner of the electronics). When attaching to metal surfaces, the M5x15 screw (according to DIN912) with spring washers is recommended. When attaching to non-metal materials the M5x70 screw for walls is recommend.

2.2.2. Cooling

For smooth operation it is necessary to provide the required thermal conditions. We recommend force cooling, with speed 1.5 m/s of fresh cooler air, through the cooling ribs,

although is possible to have cooling only with natural convection¹. By cooling with natural convection, the user should ensure at least 1 m of space over the highest cooling rib and also controller may not be located in a enclosed place.

Note: Cooling exclusively with natural convection decreases lifetime of electronics.



3. SPECIFICATIONS, FUNCTIONS AND PROTECTIONS

3.1. Mechanical and electrical specification

- Dimensions.....263,3 x 259 x 100 mm
- Weight.....4,2 kg
- Protection level.....IP55
- Power Supply:230 V/50-60 Hz; 200 V<UAC<265 V
- Efficiencyup to 95%
- Power Factor (PF):0,98
- RPM min:20% of Nominal
- RPM max:4.000 RPM

Compacto Drives	Drive Type	Input Current	Output current max	Output Power
	08	4 A; 3,6 A<Input<4,75 A	Sinusoidal 3x3,5 A	800 W
11	6 A; 5,2 A<Input<6,2 A	Sinusoidal 3x5,7 A	1100 W	

3.2. Functions

Relay Error function: Electronics are equipped with isolated Relay error function via relay 250VAC/5A, NC(4), COM(5) and NO(6).

Relay error function is activated by:

- AC input under voltage protection,
- Blocked rotor detection,
- Phase failure / Phase loss detection,
- Overheating detection,
- Controller Error detection – Internal error of electronics,
- Phase Overcurrent detection.

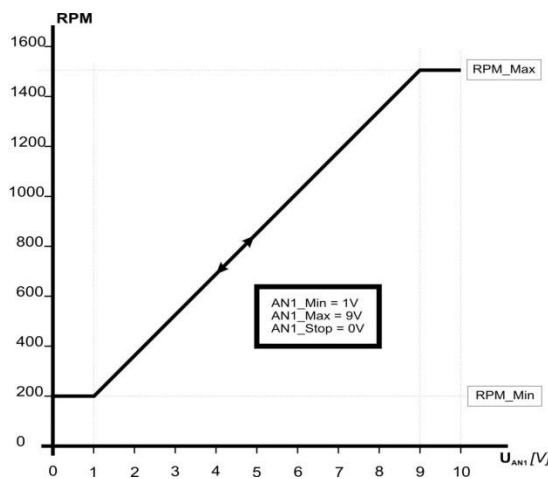
The error state is automatically reset by removal all error caused.

AN1: Analogue input 1 – Electronics can be controlled by external analogue input voltage 0-10 or 10-0 VDC to terminals (7) and (8). Electronics controls speed linear from RPM min to RPM max. Maximal or minimal speed is defined as input voltage $9,5V \pm 3\%$.

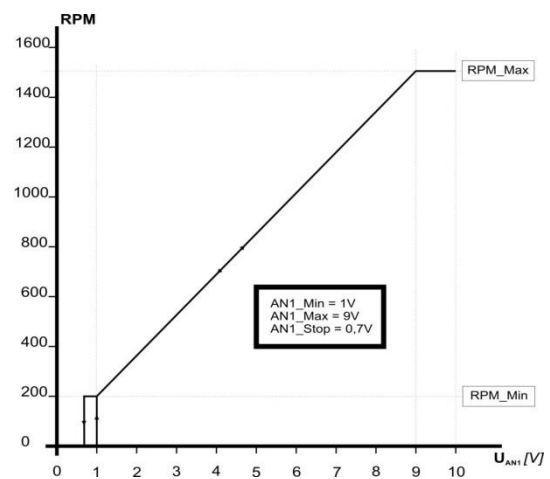
To start control the motor speed by AN1, connect Stop/Start terminal pins (18 and 19) and FIRE mode terminal pins (16 and 17) together.

AN1 can be settable by holding registers 107, 108 and 109 (see Modbus parameters in chapter 6). AN1Min parameter can be set to the desired minimum setpoint. AN1Max parameter can be set to the desired maximum setpoint. AN1Min and AN1Max can be set from 0V to 10V. If AN1Max is smaller than AN1Min function is inverted (10V to 0V). By AN1Stop, stop threshold voltage can be set. If AN1Stop is 0 threshold voltage is disabled and motor will run with minimal settable RPM. By setting AN1Stop higher than 0 motor will not run up to settable value.

Example:

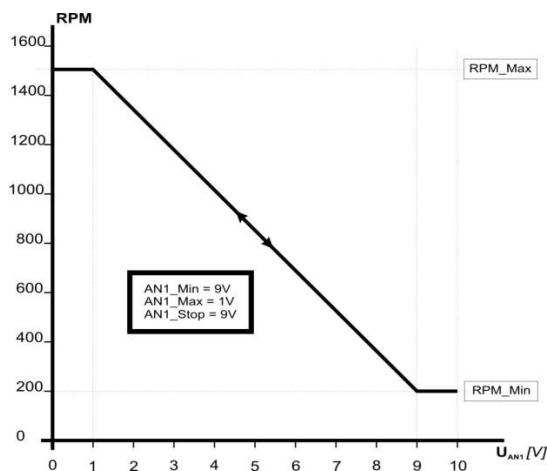


Picture 2

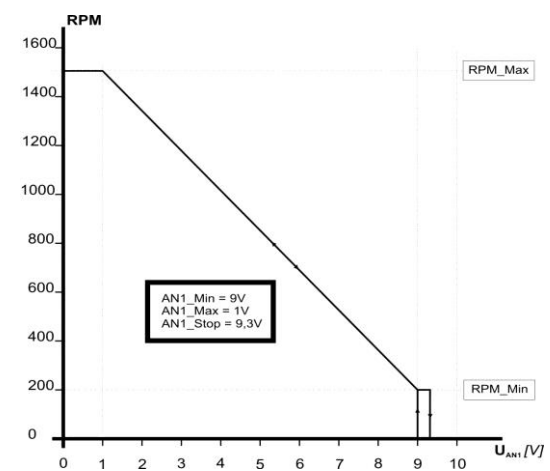


Picture 1

AN1min is set to 1V and AN1max is set to 9V. In the pictures above, controller works from 200RPM to 1500RPM. AN1 operates from 1V to 9V ($AN1_{max} > AN1_{min}$). AN1stop is set to 0V in picture 1, this means that AN1stop is disabled and motor will run with minimal RPM also in case of AN1 and POT is 0V. In picture 2 AN1stop is set to 1V. this means that threshold voltage is 1 and motor will not run below 1V.



Picture 4



Picture 3

AN1min is set to 9V and AN1max is set to 1V. In the pictures above, controller works from 200RPM to 1500RPM and AN1 operates inverted from 9V to 0V ($AN1_{max} < AN1_{min}$). AN1stop is set to 10V in picture 3, this means that AN1stop is disabled and motor will run with minimal RPM also in case of AN1 and POT is 10V. In picture 2 AN1stop is set to 9V. This means that threshold voltage is 9V and motor will not run higher than 9V.

Hysteresis regulator will be preset in Domel on customer's specifications.

Electrical parameters: $V_{in_{max}}=12V$, $Z_{in}=10k\Omega$, Resolution 10-bit, tolerance $AN1\pm 5\%$

Important: Wrong polarity at input AN1 could cause serious damage on the controller.

Set RPM via potentiometer: Electronics can be controlled by external potentiometer (4k7 to 47kΩ) connected to terminals (8=gnd), (9=input) and (10=+5V). If the direction of rotary potentiometer is incorrect, change the wires on terminal (8) and (10).

Electrical parameters: Three-wire, $R_{pot}=4k7-47k\Omega$, $Z_{in}=10k\Omega$

Power supply 5VDC/10mA: Electronics are equipped with 5VDC/10mA for power supply to an external potentiometer. Power supplying other loads is not allowed. The 5 VDC supply is galvanically isolated from the supply voltage, but has the same potential as the analogue and digital inputs and outputs.

Electrical parameters: 5VDC +/- 5% (regulated); 10mA; Terminal number: 10.

Power supply 24VDC/40mA: Electronics are equipped with 24VDC/40mA power supply for external sensor connected via AN2, or for small external fan for cooling controller. The 24 VDC supply is galvanically isolated from the supply voltage, but has the same potential as the analogue and digital inputs and outputs.

Electrical parameters: 23VDC +/- 10% (not regulated); 50mA; Terminal number: 13, 16, 19.

AN2: Analogue input 2 – Electronics can be controlled by external analogue input signal AN2 for external sensor (temperature, CO2, smoke sensor, etc.).

Electrical parameters: $V_{in,max}=12V$, $Z_{in}=10k\Omega$, Resolution 10-bit

Important: Wrong polarity at input AN2 can cause serious damage on the controller.

PID Control:

Electronics are equipped with internal PID regulator via AN2. The PID Control uses the value on the AN1 as Set Point value.

For additional PID control parameter setting see chapter 6 (Controller configuration).

Speed output: Electronics are equipped with an Open Collector speed output signal for speed monitoring.

Speed output mode could be set as:

- Frequency output $f=1Hz/1RPM$ @ 25mA, (1Hz means 1RPM, max frequency is determined by the max RPM)
- PWM output – $D=0\% \leftrightarrow RPM=0$, $D=100\% \leftrightarrow RPM=100\%$,
- PWM output – 10V / 1mA,
- Current generator output 0-20 mA,
- Current generator output 4-20 mA,
- Voltage generator output 0-10 V/1 mA
- Voltage generator output 2-10 V/1 mA
- Voltage generator output 0-10 V/1 mA calculated regarding actual RPM with 5% tolerance.

SO mode 9 (Chapter 6) is calculated by equation:

$$Speed\ Output = \frac{AN1Min + (RPM - RPMMin) * (AN1Max - AN1Min)}{RPMMax - RPMMin}$$

For additional parameter setting see chapter 6 (Controller configuration).

Fire mode function: Electronics are equipped with Fire mode function. In this case electronics runs as emergency controlled unit, (for example: extract the smoke from a burning building), with disabled protections and functions.

In fire mode case:

- Overheating protection - disable,
- Under voltage protection - disable,
- Start/Stop function – ignore,
- Set RPM via AN1 or Potentiometer – ignore,
- Set RPM via AN2 – ignore,
- Phase overcurrent – disable,
- Controller error detection - disable.

In Fire mode function electronics runs with Fire mode set parameters. These parameters should be sets via Modbus registers. The function should be enabled by disconnect the terminal pins (16) and (17). We recommended purpose switch. For disable the function disconnect terminal pins (switch=ON).

Fire mode function can be also enabled via Modbus communication. For additional information about activating fire function via Modbus, see the chapter 7.

Electrical parameters: Operating voltage = 24V, $Z_{in}=10k\Omega$



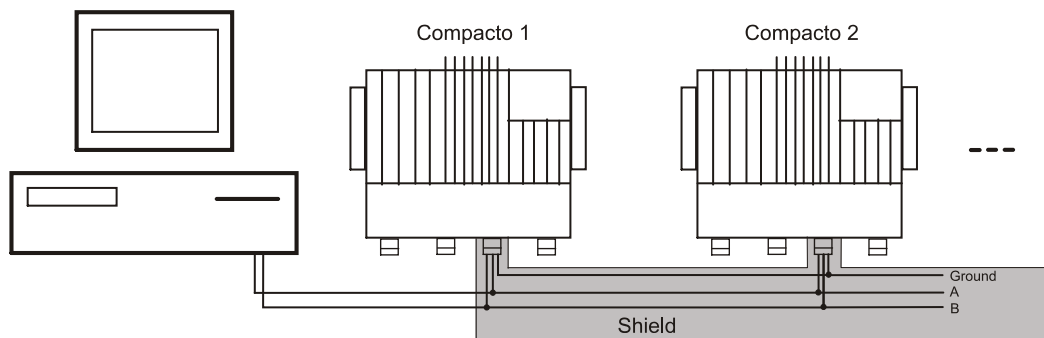
Note!

Fire mode function is useable only for protection in case of a burning building, to extract the smoke from it. In normal condition the fire mode function is not allow to be used. In this case Domel is not responsible for damage to the controller caused by improper use.

Star/Stop function: Electronics are equipped with Start/Stop function. If the controller has all conditions for running, the motor goes runs when the terminal pins (18) and (19), are connected together.

Electrical parameters: Operating voltage = 24V, $Z_{in}=10k\Omega$

Modbus RTU 485 serial communication: Electronics are equipped with Modbus RTU 485 communication. To connect controllers into chain use only shielded cables.



Shielded cable for ground connection between controllers is necessary (terminal pin 14).

Speed control via MODBUS:

Parameter "Operation Mode" set to value 2 - Operation Mode = 2. The ON/OFF Switch becomes inactive. To the Holding register at address 0 (Set_Point) write desired value of speed in %.

For example:

Set_Point < 1000 (10,00 %) ... Motor Stop

Set_Point = 1000 (10,00 %) ... Motor Run at RPM_Min

1000 (10,00 %) < Set_Point <= 10000 (100,00 %) ... Motor Runs at desired speed.

The motor speed is calculated by equation:

$$Speed[RPM] = RPM_Min + \frac{RPM_Max - RPM_Min}{9000} * Set_Point[\%]$$

For additional information about Modbus parameters see chapter 5.

3.3. Protections

Thermal protection: The electronics are equipped with reducing thermal protection. This function is a temperature limiter which reduces the output power, when temperature on the controller rises over 75°C. In this case relay error function set output error.

In the event that the temperature of controller is still rising (over 105°C) the controller stops the motor. When the temperature controller falls below 75°C, the motor automatically restarts.

Thermal protection is disabled in fire mode state.

Under and over voltage: The electronics are equipped with under and over voltage protection. Electronics shutdown when the main voltage is not in the required range. See mechanical and electrical specification.

Blocked rotor protection: The electronics are equipped with blocked rotor protection when the rotor of motor is blocked or it is impossible to rotate it. Electronics automatically retries 25 restarts, than a manual restart by disconnecting the power supply is required.

Motor phase fail / lose: The electronics are equipped with motor phase fail protection in event that one of phase motors is damage or missing. In this case electronics stops the motor immediately. Protection is disabled in fire mode state.

Phase overcurrent protection: The electronics are equipped with phase overcurrent protection when current through motor increases up to 10A. In this event electronics stops the motor immediately and tries to makes automatically restart.

Rotor failed acceleration: The electronics sre equipped with rotor failed acceleration protection when the rotor is damaged or is hard to rotate. Electronics automatically retries 25 restarts for every 1second. If the 25th restart is still unsuccessful, then manual restart by disconnecting the power supply is required.



Note!

Heating the controller over the maximal temperature is not allowed.

Above 105°C electronics stops the motor (not in fire mode state), and restarts it again when the temperature of controller falls below 75°C. However, if the controller is overheating and motor was shutdown, disconnect power supply (safety switch) and wait at least 20 minutes before you service them. In case of overheating of controller, the metal parts of them are very hot and could cause serious damage to your skin.

If controller starts reducing output power during running, this may be reason of overheating. In this case add small 24V/40mA fan on controller or ensure air flow through the ribs. Fan can be supplied by power from controller (chapter 4.2. – wiring diagram). Overheating problem appears in the case of installation of the controller in the space without air flow.

4. STRIPPING CONNECTING LEADS AND CONNECTING WITH TERMINALS

Use shield / armoured motor cable to comply with EMC emission specifications, and connect this cable to both the decoupling plate and the motor metal.

Use only hard wire or fibre copper wire with ferrule (Fig 1). For thickness of the wire, see the table 2.

Keep motor cable as short as possible to reduce the noise level and leakage currents. To reduce the operating problems, use a shielded cable. Max length of cables shown the table below.

Compacto	Length max [m]
Power supply	-
Relay Fault	-
Set RPM via voltage	-
Set RPM via potentiometer	20
Speed Output	-
Fire mode	40
Start/Stop	40
Modbus	40
Motor	5

Table 1: Length of cables

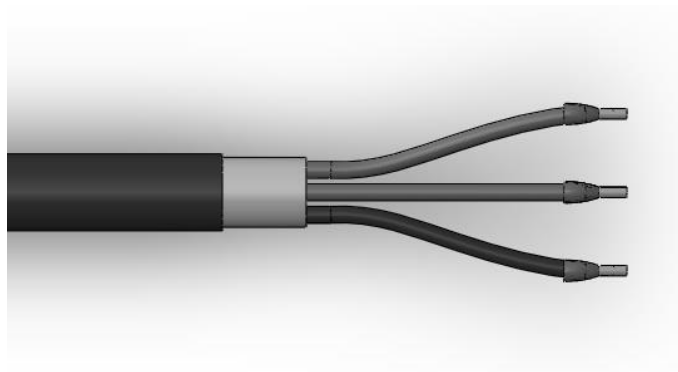


Fig.1: Wire with ferrule

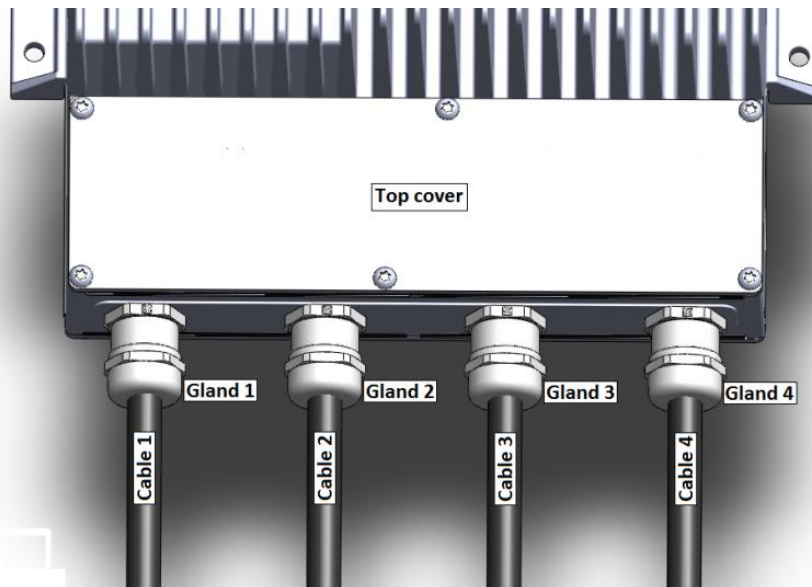


Fig.2: Description of cables

4.1. Connection instructions:

- a) Remove the Top cover of the terminal strips (Fig.2).
- b) Unscrew the nut of cable gland 4. Insert the motor cable through the gland and mount the cable shield (Fig.3). Press the terminal strip 5 (Fig.3 and 4) and connect the motor wires to the terminal strip 5. Tighten the nut of cable gland 4 for optimum IP protection.
- c) Unscrew the nut of cable glands 3 and remove the sealing insert for sealing. Insert the control cable (Cable3). Mount the cable by shield (Fig.3). Press the terminal strip 4 (Fig.3 and 4) and connect control wires to the terminal strip 4. Tighten the cable gland 3 for optimum IP protection.
- d) Unscrew the nut of cable glands 2 and remove the sealing insert for sealing. Insert the control cable (Cable2). Mount the cable (Fig.3). Press the terminal strip 3 (Fig.3 and 4) and connect control wires to the terminal strip 3. Tighten the cable gland 2 for optimum IP protection.
- e) For power supply and Relay Fault function use one cable with 6 wires if Relay Fault is needed. Unscrew the nut of cable glands 1. Press the terminal strip 1 (Fig.3 and 4) and connect the Power wires to the terminal strip 1. Press the terminal strip 2 (Fig.3 and 4) and connect the wires for Relay Fault. Tighten the cable gland 1 for optimum IP protection. Do not lead Relay Fault cable through control cable glands 2 and 3. It could cause defect signals on control wires.
- f) If there is any blank cable gland, fill it with a sealing insert to seal.
- g) Check all connections again and carefully replace the Top cover. Screw the top screw
- h) Connect the Power supply voltage.

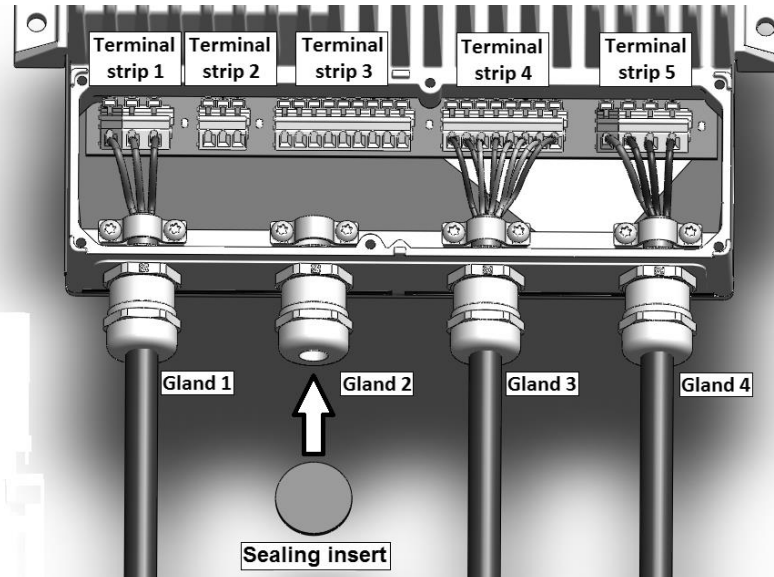


Fig.3: Example how to install cables, wires and install the sealing insert for sealing cable gland.



Warning!

Use cable with minimal 7mm thickness. All unused glands must be closed. Use appropriate sealing insert or appropriate stopper if you not use cable. Top cover must be tight with 1Nm of torque and all screws must be used. These actions must be done to avoid humidity and water absorption inside controller. Water inside of controller may cause serious damage on working.

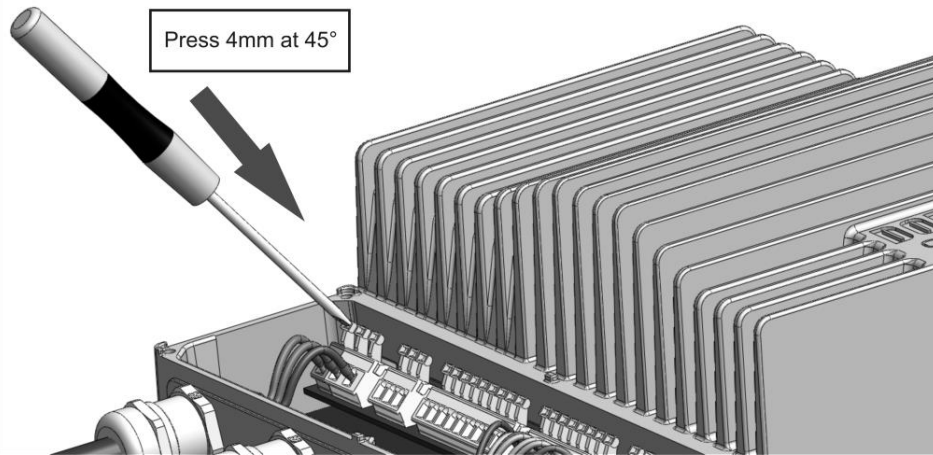


Fig.4: How to operate correctly with terminal strips



Warning!

Press only 0.5kg max, 4mm deep at angle 45° with 3mm slot screwdriver. Damaged terminal strips could cause fatal damage on the Controller and could cause fatal injury from electric shock.



Note!

It is the responsibility of the user or installer to ensure correct grounding and protection in accordance with national and local standards.

4.2. Connecting the electrical system

Check whether the data on the type plate agrees with the connection data.

Before connecting the device, ensure that the supply voltage matches the operating voltage of the device.

Only use cables that are configured for the current according to the specification on the type plate.

4.2.1. Mains supply connection and fuse protection

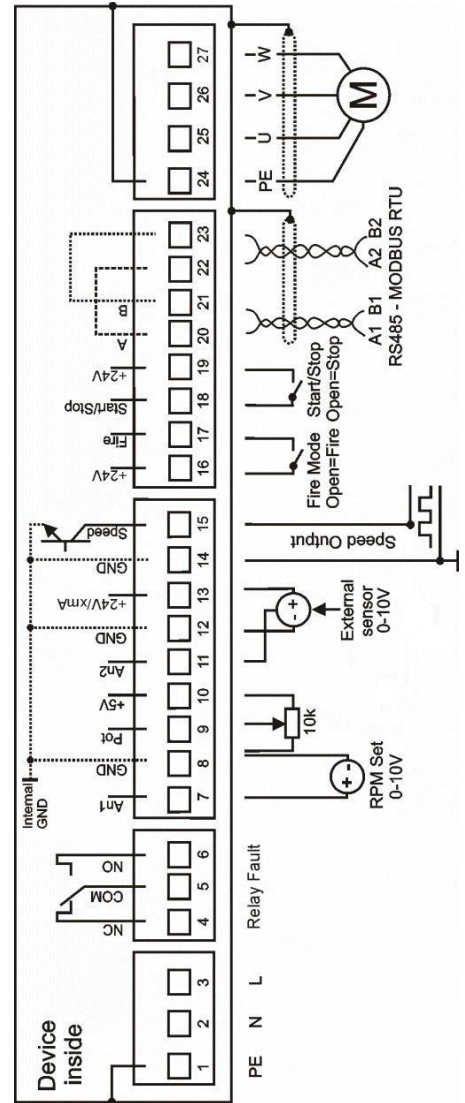
<i>Compacto</i>	Drive Type	Nominal voltage	Nominal output power	Safety fuse	Cable cross - section	
					mm ²	AWG
Power supply	08	230V	800W	10A	2,0-2,5	13
User control					0,5 - 2,5	20 - 13
Power supply	11	230V	1100W	10A	2,0-2,5	13
User control					0,5 - 2,5	20 - 13

Table 2: Thickness of wire



Connect the device only to the circuits that can be switched off using an all-pole disconnecting switch.

	Terminal number	Description	
Mains supply	PE	1	PE connection
	N	2	Supply voltage
	L	3	
Relay Fault	NC	4	Normally close
	COM	5	Common connection; Contact rating 250V / 5A
	NO	6	Normally open
Control	AN1	7	Analogue Input 1; Set value 0-10 V or 10-0 V; $R \geq 1 \text{ k}\Omega$
	GND	8, 12, 14	I/O ground
	Pot	9	Potentiometer output (3 wires)
	+5V	10	+5 V \pm 5 % / 10 mA for potentiometer
	AN2	11	Analogue Input 2 for external sensor (PID Control)
	+24V	13, 16, 19	+24 V \pm 10% DC / I _{max} 40 mA
	Speed	15	Digital output; NPN open collector output
	Fire	17	Digital input; FIRE mode: Enabling function – open pin; Disabling Bridge to +24 V
	Start/Stop	18	Digital input; Start/Stop mode: Disabling function – open pin; Enabling Bridge to +24 V
	A	20, 22	Bus connection RS485 – A; MODBUS RTU
B	21, 23	Bus connection RS485 – B; MODBUS RTU	
Motor	PE	24	Motor connection
	U	25	
	V	26	
	w	27	



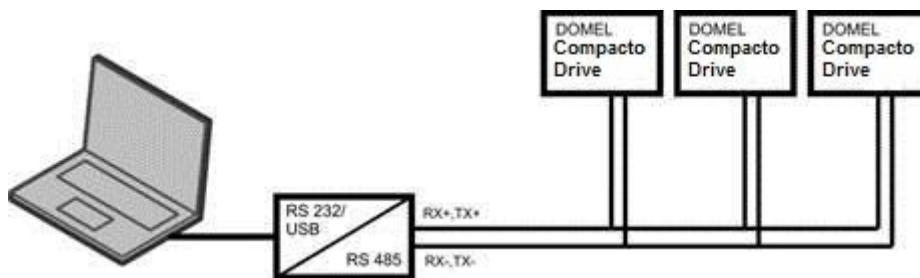
5. MODBUS RTU

The MODBUS RTU protocol is based on the built-in RS-485 (EIA-485) interface. RS-485 is a two-wire bus-interface that allows multi-drop network topology i.e. nodes can be connected as a bus (daisy chain), or via drop cables from a common trunk line.

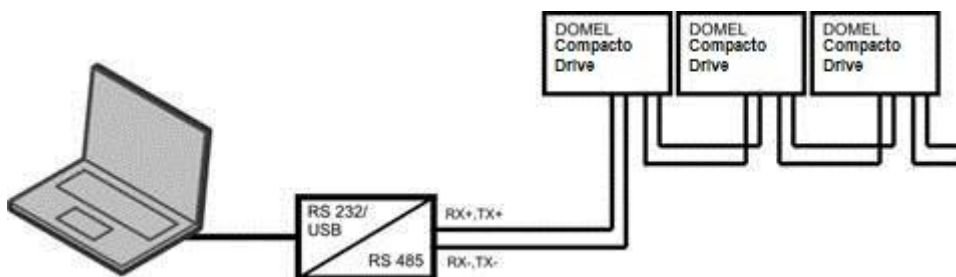
Domel's Compacto drives uses the two-wire system where the communication between master and slave is half-duplex, i.e. it cannot transmit and receive at the same time. Each signal uses one twisted-pair line — two wires twisted around themselves. The signal on one wire is ideally the exact opposite of the signal on the second wire. Since RS-485 is a multipoint communication system, all devices are connected to the single twisted-pair cable.

The Modbus RTU uses master/slave architecture, where each slave device has its unique address and responds only to packets addressed to this device. The packets are generated by the master (Controller), which periodically polls all connected slave devices. Data travels over the single line in both directions.

One or more EC drives can be connected to a control (or master) using the RS-485 standardized interface. Maximal number of Compacto EC Drives connected to the network is 32. If more than one frequency converter is connected to a master, use parallel connections. Terminal 14 is connected to the signal TX+, RX+, while terminal 15 is connected to the signal TX-,RX-.



Parallel connections



“Daisy chain” connection

Default Configuration (set by Domel):

- MODBUS address: **1**
- Baud Rate: **19200**
- START Bit: **1**
- STOP Bit: **1**
- Parity: **NONE**

Supported MODBUS commands:

- 0x01: Read Coils
- 0x02: Read Input
- 0x03: Read Holding Registers
- 0x04: Read Input Register
- 0x05: Write Single Coil
- 0x06: Write Single Holding Register

To connect PC and DOMEL Compacto Drive over serial line (MODBUS) RS-232/USB to RS-485 Converter is needed. We recommend ADAM-4561 converter. To attach the ADAM-4561 to a PC, you do not need to power down your PC. The power for the ADAM-4561 converter is derived from the USB port, so there are no power adapters to deal with.

The ADAM-4561 device driver can be used in combination with Windows 2000/XP/Vista/7 (32 & 64-bit).

6. MODBUS PARAMETERS

Configuration
MODBUS RTU: 19200-8-N-1
Slave addr: 0x1 (default settable by MB_ADR:0007)
(Strikethrough text indicates partially implemented or unimplemented function)

Coils			
Address	Function	Range	Description
0	Motor ON/OFF	0-1	Indication, 1=ON, 0=OFF
1	Reset Controller	0-1	1=Reset controller
2	Fire active	0-1	1=Fire mode active

Discrete status bits (inputs)			
Address	Function	Range	Description
0	Under Voltage	0-1	1=Voltage too low to run
1	Over Voltage	0-1	1=Voltage too high to run
2	IGBT Overcurrent	0-1	1=Overcurrent protection tripped
3	Hot	0-1	1=Temperature protection active, power reduced
4	Phase Loss	0-1	1=Phase or motor sync loss
5	PFC Overcurrent	0-1	1=PFC FET protection tripped
6	Parameters CRC	0-1	1=Parameter checksum failed (TBD)
7	Circuit Fault	0-1	1=There was an error detected during circuit internal check
8	Motor Fault	0-1	1=Motor does not behave as expected
9	Too Hot	0-1	1=Converter too hot to operate
10	I2R IGBT Fault	0-1	1=Software IGBT protection triggered
11 - 13	RESERVED		
14	Restart Fault	0-1	1=Fault condition repeated several times in a short time. Converter power should be power cycled or reset.
15	On Fire	0-1	1=Fire input was activated
16	Run Active	0-1	1=Run input was activated
17	Relay Active	0-1	1=Relay output is active
18	Waiting To Stop	0-1	1=Motor should be stopped, but is still spinning
19 – 23	RESERVED		
24	RpmReg	0-1	Speed regulator active
25	PowerReg	0-1	Power limit regulator active
26	IacReg	0-1	Line current regulator active

27	OvermodReg	0-1	Over modulation reached. Converter can no longer supply the voltage required by motor.
28	RegenReg	0-1	Motor is in regeneration. Speed increased to prevent DC link over voltage
29	IphaseReg	0-1	RMS motor phase current limit reached
30	SyncReg	0-1	Motor is still in Synchronous mode
31	RESERVED		

ACCESS LEVEL:

- 0 – read only**
1 – basic user settings
2 – service settings

Holding Registers					
Address	Function	Range	Resolution	Description	LEVEL
0	Set point	0..10000	0,01%	Performance set point for speed depends on operation mode.	1
1	Direction	0..65535	1	Motor direction: 0: Reverse >0: Forward	2
2	Maximum Speed	MinRPM.. MaxRPM[level+1]	1	Max rpm allowed in normal operation. External control will use this as set point maximum. Value from level above current is used as Max.	1
3	Fire Speed	0.67*RPM_Max to RPM_Max	1	RPM when fire mode is active (2/3*RPM_Max to RPM_Max)	2
4	Minimal Speed	200 RPM to Max RPM	1	Minimal allowed speed	1
5	Password	0..32767		0: level 0, all settings locked (default password for level 1) 1: password for current level will be disabled with 10020 10000: store values to EEPROM at current level (will override lower levels) 10001: restore values from EEPROM (last saved values) 10002: restore default values from one level above current 10020: set previous value as password (will not be accepted if desired password matches 10000..11000 or level is <1) See 1: for how to disable password When level is changed, stored values for the level will be loaded	1

6	Operation Mode			0: AN1 or POT Speed (default) 2: MODBUS Speed (run switch inactive) 9: PIDRef (addr 16)-AN2 Speed regulator (heat) 10: AN2- PIDRef (addr 16) Speed regulator (cool) 11: AN1-AN2 Speed regulator (heat) 12: AN2-AN1 Speed regulator (cool) -1:FIRE Mode (>when in access level >=2 »motor will run at »Fire Speed«)	1
7	Modbus Address	1..247	1	Set Modbus address: Write 10000 to Password to save. Restore by writing to broadcast address (0) (in case you forgot address)	1
8	RESERVED				
9	Fire Limit			Fixed fire speed (settable by reg. 3 if 0)	2
10	RegIndex				
11	Kp	100..32000	0.001 (0.1 min, 32 max)	External controller proportional gain	1
12	Ti	0..32000	0.1s (3200s max)	External controller Integration time 0: no integration	1
13	Td			External controller diff. time	1
14	PIDMin	0..10000	0.01%	PID regulator minimum output	1
15	PIDMax	0..10000	0.01%	PID regulator maximum output	1
16	PIDRef	0..1000	1	PID regulator reference selection	1
20 - 27	FACTORY SETTINGS				
28	Resonance1	0..10000	1	Rpm where 1 st resonance occurs (set 0 to ignore). Converter will avoid this rpm. Avoidance will only work if rpm regulator is active.	1
29	Resonance2	0..10000	1	Rpm where 2 nd resonance occurs (set 0 to ignore)...	1
30	Resonance3	0..10000	1	Rpm where 3 rd resonance occurs (set 0 to ignore)...	1
31	Resonance Width	2..20%	1	Width of resonance avoidance band. Example: R28=1000, R31=20 Converter will avoid 900-1100 rpm.	1
Controller configuration					
100	Speed output mode	0..8		SO output Mode: 0: disabled (input), 1: FREQ(25mA), 2: FREQ(10V, 1mA), 3: PWM(25mA), 4: PWM(10V,1mA) 5: 0..20mA, 6: 0..10V(1mA), 7: 4..20mA, 8: 2..10V(1mA), 9: 0..10V (1mA) – calculated regarding actual RPM. See chapter 3.2. >9: reserved	1

101	SO output signal	-10000..2	0.01%	<1: Manual output value (-10000=100%) 1: Motor RPM 2: Set Point >2: reserved	1
102 - 106	RESERVED				
107	AN1Max	0..1000	0.01V	Voltage for maximum setpoint. Transfer function is inverted if AN1Max < AN1Min.	1
108	AN1Min	0..1000	0.01V	Voltage for minimum setpoint	1
109	AN1Stop	0..1000	0.01V	0: disable stop AN1Stop >0: Stop threshold voltage.	1

Input Registers				
Address	Function	Range	Resolution	Description
0	HW Version		1	Hardware version
1	FW Version		1	Firmware version
2..3	RESERVED			
4	Speed	0..32767	1	RPM
5	Controller temperature	-50..150	0.01	°C
6	UDC		0.1	DC Bus voltage in V
7	Stator IRMS		0.001	RMS Stator current in A
8	Power		0.1	W
9	Analogue1	-300..2000	0.01V	Analogue input 1 voltage
10	Analogue2	-300..2000	0.01V	Analogue input 2 voltage
11	Analogue POT	-300..2000	0.01V	Analogue POT voltage
12	SO voltage	-300..2000	0.01V	SO output voltage
13	SO current	-300..3300	0.01mA	SO output current
14	IAC		0.001	Line RMS current in A
15 - 18	RESERVED			
19	Error Code	0..7, -1		Red LED error codes (priority in the order below): 7 = motor failed to start repeatedly 6 = under or overvoltage 5 = motor misconnected/faulty 4 = internal frequency converter fault 3 = temperature protection active 2 = active overcurrent protection 1 = slow blink = standby -1 = fast blink (fire activated) 0 = always on (operating normally)
20	Fire Minutes			Minutes under fire mode
21	Fire Days			Days under fire mode
22	Fire Cycles			Fire activated counter

23	Op Minutes			Minutes of operation
24	Op Days			Days of operation (RPM>0, no error)

7. TROUBLESHOOTING

The power supply must be disconnected for at least 5 minutes before the EC controller is opened. Otherwise the unit may contain residual current capable of causing serious injury.

COMPACTO	Errors/Warnings	Relay error Message	Modbus error Warning	Restart Required Manual Restart *	Restart Required Auto Restart	Limits/Remarks
1	AC input undervoltage	X	X		X	60V < UAC < 200V
2	AC input overvoltage		X		X	UAC > 265V
3	Blocked rotor	X	X	X		Manual restart required after 25 automatically restarts
4	Failed rotor acceleration		X		X	Auto restart after 1s; After 25 automatically restarts, manual restart required
5	Phase failure/phase loss	X	X	X		Phase damage/missing motor phase
6	Overheating windings		X			No overheating windings protection
7	Overheating electronics		X			Temp. electronics > 80°C. reducing output power
		X	X		X	Temp. electronics > 105°C. Motor shutdown: Decreasing Temp. of electronics below 75°C. Automatically restart
8	Controller error (internal error of electronics)	X	X	X		
9	Phase overcurrent	X	X	X		Motor phase current > 10A
		X	X	X		Contact motor phase to earth (PE)
10	Fire mode activated		X			Fire mode function activated – some protection are disabled
11	PFC Overcurrent	X	X		X	protection tripped
12	Motor fault	X	X		X	something is wrong with motor
13	Run active		X			Indicator
14	Relay active		X			Indicator
15	Waiting to stop		X			Indicator - Tells when motor stop

*Disconnect controller from Power distribution network for 5 min