Premium
Powering Your Challenge

CLS-75

75W ULTRA-WIDE INPUT 16.8V-137.5V

GENERAL FEATURES:

Designed according to EN50155
Fire and smoke: EN45545-2
High input-output isolation
Hold-up time Class S1
Remote (on/off) and DC OK signal
Input reverse polarity protection
Efficiency up to 92.5%
Active input reverse polarity protection
Active inrush current limitation - network protection
Parallel and redundant operation
120% Peak load capability to 90W for 10s



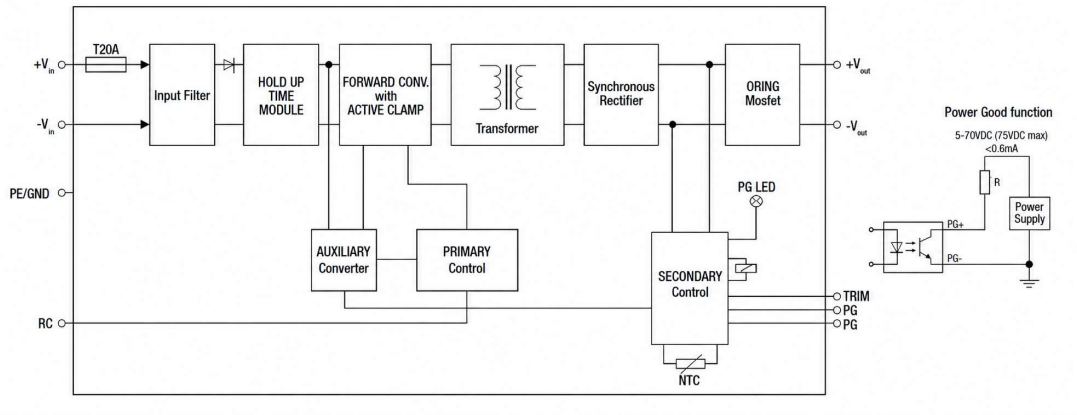
5 YEAR WARRANTY
EN45545 fire & smoke
EN50155
ROHS REACH

SELECTION GUIDE

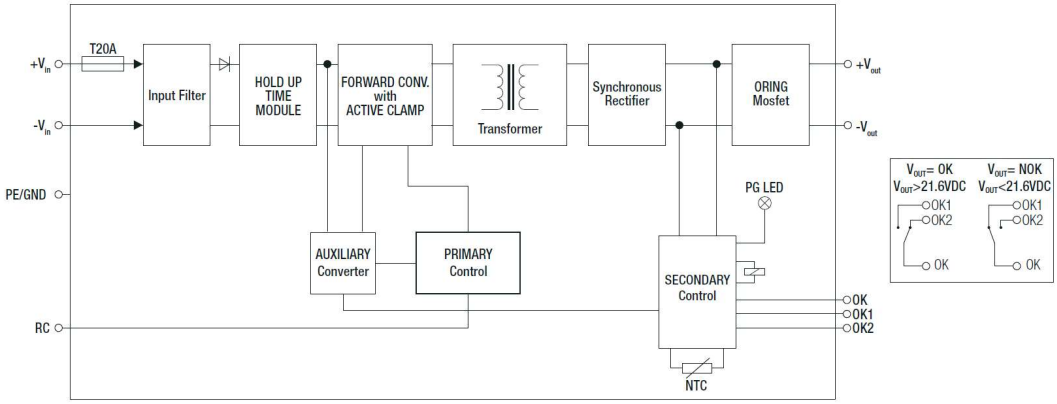
Part Number	Input Voltage Range	Output Voltage Range	Output Current		Efficiency typ.	Continuous Output Power
			Cont	10 ms	[%]	[W]
	[V_{DC}]	[V_{DC}]	[A]	[A]		
CLS-75-36516	16.8-137.5	24	6.25	7.5	91	75
CLS-75-36524	16.8-137.5	12	3.125	3.75	92.5	75

Block Diagrams

Standard Connectors



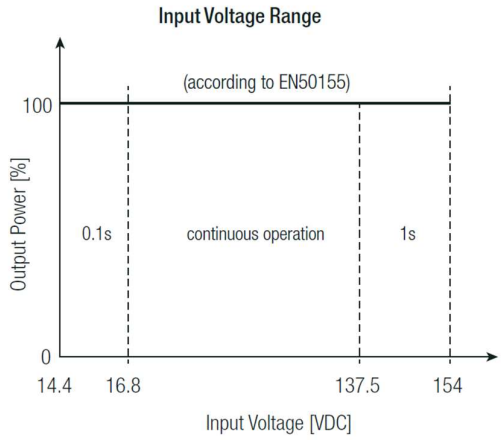
Push in connectors Version



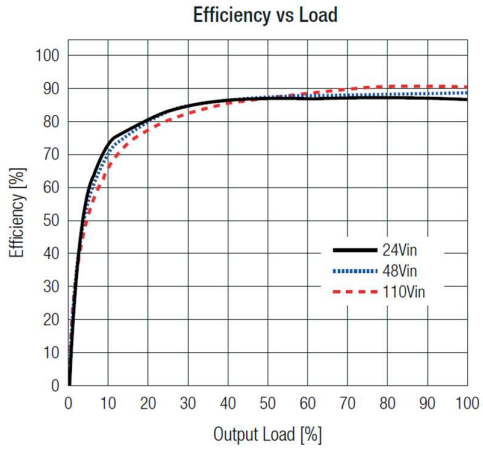
Description

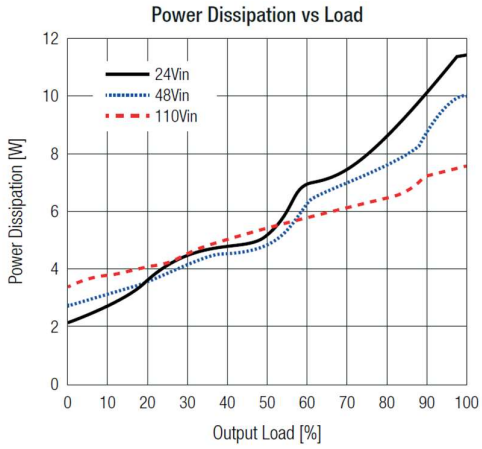
The chassis mountable CLS-75 series DC/DC converter is designed for railway and transportation applications and is compliant with all relevant standards: EN50155, EN50121-3-2, DB-EMV06, EN50124-1, EN50125-1, EN61373 1B, EN62368-1, EN45545-2. The unit is designed with 11:1 input voltage range to cover the input voltages from 14.4VDC up to 154VDC for nominal 24, 36, 48, 72 and 110V in one range for all applications - on every vehicle worldwide. The isolated and regulated 24V/12V output works with a reinforced isolation system.

Due to the base plate mounting the unit operates with full power within the wide temperature for OT4+ST1&ST2 class from -40°C to +85°C and no additional cooling systems are necessary. Input reverse polarity protection, inrush current limitation, 10ms hold-up time, remote control, and output OR-ing diode and efficiency of up to 92% round up the functionality of this fully railway compliant Plug&Play unit.



CLS-75-36516





BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)						
Parameter	Conditions			Min.	Typ.	Max.
Input Voltage Range	refer to "Input Voltage Range"	nom. V_{IN}= 24, 36, 48, 72, 110VDC		16.8V_{DC}		137.5V_{DC}
		according to EN 50155	100ms max	14.4V_{DC}		16.8V_{DC}
			1s max.	137.5V_{DC}		154V_{DC}
Input Capacitance	internal				4µF	
Under Voltage Lockout	rising edge			15V_{DC}		16V_{DC}
	falling edge					14.4V_{DC}
	hysteresis				1V_{DC}	
Input Current	V_{IN}=16.8V_{DC}			5.1A	5.45A	7A
	V_{IN}=24V_{DC}				3.5A	4.7A
	V_{IN}= 110V_{DC}				0.75A	1A
	V_{IN}= 137.5V_{DC}					0.8A
Inrush Current	active inrush current limitation (<3.5 x Inom)					14A
No Load Power Consumption	V_{IN}= 16.8V_{DC}				1.9W	
	V_{IN}= 110V_{DC}				1.4W	
Standby Power (shutdown by remote)						1W
Output Current Range	continuous operation	CLS-75-36524		0A		6.25A
		CLS-75-36516		0A		3.125A
	10s max., refer to "Peak load	CLS-75-36524				7.5A

	Capability" T_{AMB}= 70°C max.	CLS-75-36516			3.75A
Nominal Output Voltage (factory set)	CLS-75-36524			$12V_{DC}$	
	CLS-75-36516			$24V_{DC}$	
Output Voltage Trimming (not available for P option)	CLS-75-36524		$10.8V_{DC}$		$13.2V_{DC}$
	CLS-75-36516		$21.6V_{DC}$		$26.4V_{DC}$
Minimum Load			0%		
Start-up time	V_{IN}= $24V_{DC}$				1s
	V_{IN}= $110V_{DC}$				1s
	by using CTRL ON/OFF function				0.2s
Rise time	V_{IN}= $24V_{DC}$, $110V_{DC}$				100ms

BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)					
Parameter	Condition		Min.	Typ.	Max.
Hold-up time	V_{IN}= $16.8V_{DC}$		10ms		
	V_{IN}= $110V_{DC}$		30ms		
ON/OFF CTRL	DC-DC ON		open or connected to $+V_{IN}$		
	DC-DC OFF		connected to $-V_{IN}$		
Input Current of CTRL pin	DC-DC ON				10mA
Internal Operating Frequency				88kHz	
Output Ripple and Noise	10µF electrolytic capacitor in parallel across the output (low ESR)	ripple		1% of V_{OUT}	
		noise		2% of V_{OUT}	
Maximum Capacitive Load	CLS-75-36516-S			4000µF	

ORDERING CODES

CLS –75– 365 _ _ _ _

S standard connector
P for push-in terminal connector/Relay changeover
D DIN rail click

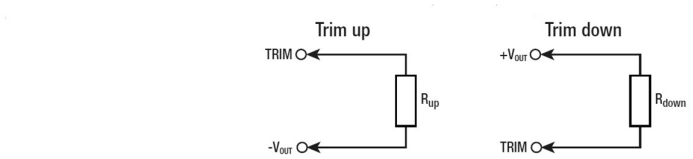
Model Number

ORDERING INFORMATION

Part Number	Nom. Output Voltage	Power Good	Connector	Trimming function	Peak Power
CLS-75-36516-S	$24V_{DC}$	open collector	standard connector	yes (21.6-26.4V_{DC})	90W/10sec max.
CLS-75-36516-P	$24V_{DC}$	Relay changeover contact	WAGO cage clamp	no	90W/10sec max.
CLS-75-36516-SD	$24V_{DC}$	open collector	standard connector	yes (21.6-26.4V_{DC})	no
CLS-75-36516-PD	$24V_{DC}$	Relay changeover contact	WAGO cage clamp	no	no
CLS-75-36524-S	$12V_{DC}$	open collector	standard connector	yes (10.8-13.2V_{DC})	90W/10sec max.
CLS-75-36524-P	$12V_{DC}$	Relay changeover contact	WAGO cage clamp	no	90W/10sec max.
CLS-75-36524-SD	$12V_{DC}$	open collector	standard connector	yes (10.8-13.2V_{DC})	no
CLS-75-36524-PD	$12V_{DC}$	Relay changeover contact	WAGO cage clamp	no	no

OUTPUT VOLTAGE TRIMMING

The output voltage of the CLS-75 can be trimmed between ±10% by using an external trim resistor. The P version does not support this feature. The values for the trim resistor are according to standard E96 values; therefore, the specified voltage may slightly vary. Resistor values may be calculated with the following equation:



$Vout_{nom}$ = nominal output voltage [VDC]
$Vout_{set}$ = trimmed output voltage [VDC]
V_{ref} = reference voltage [VDC]
R_{up} = trim up resistor [Ω]
R_{down} = trim down resistor [Ω]
k_u = trim up factor [ ]
k_d = trim down factor [ ]

Calculations:

$$k_u \cong \left[\frac{V_{REF}}{V_{OUTset} - V_{REF}}\right] \times R_1 \qquad R_{up} \cong \left[\frac{k_u \times R_2}{R_2 - k_u}\right] - R_3$$

$$k_d \cong \left[\frac{V_{OUTset} - V_{REF}}{V_{REF}}\right] \times R_2 \qquad R_{down} \cong \left[\frac{k_d \times R_1}{(R_1 - k_d}\right] - R_3$$

Model	R_1[Ω]	R_2 [Ω]	R_3 [Ω]	V_{ref} [V_{DC}]
CLS-75-36524	16k	4.2k	7.8k	2.5
CLS-75-36516	35.3K	4.1k		

CLS-75-36524

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Voutset =	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.2	[VDC]
Rup (E96) ≈	287k	150k	100k	73.2k	57.6k	46.4k	39.2k	33.2k	28.7k	24.9k	[Ω]

Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
Voutset =	11.88	11.76	11.64	11.52	11.4	11.28	11.16	11.04	10.92	10.8	[VDC]
Rdown (E96) ≈	1.43M	649k	412k	301k	237k	191k	162k	137k	118k	105k	[Ω]

CLS-75-36516

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Voutset =	24.24	24.48	24.72	24.96	25.2	25.44	25.68	25.92	26.16	26.4	[VDC]
Rup (E96) ≈	412k	187k	121k	86.6k	68.1k	54.9k	45. 3k	39.2k	34k	29.4k	[Ω]

Trim down	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	[%]
Voutset =	23.76	23.52	23.28	23.04	22.8	22.56	22.32	22.08	21.84	21.6	[VDC]
Rdown (E96) ≈	2.74M	1.43M	976k	732k	576k	475k	402k	348k	301k	267k	[Ω]

REGULATIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)		
Parameter	Conditions	Value
Output Accuracy		±3.0% max.
Line Regulation	low line to high line, full load	±0.5% max.
Load Regulation	0%-100% load	2.0% max.
Transient Response	10-90% load, V_{IN}= 16.8-137V_{DC}	1.2V_{DC}
	recovery time	5ms max.

PROTECTIONS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)			
Parameter	Type		Value
Internal Input Fuse			T20A, slow blow type
Short Circuit Protection (SCP)			constant current mode, auto recovery
Short Circuit Input Current	V_{IN}= 24V_{DC}		3.4A
	V_{IN}= 110V_{DC}		0.7A
Input Reverse Polarity Protection	active protected		-137.5V_{DC}
Over Voltage Protection (OVP)	clamping		120% - 140% of nom. V_{OUT}
Over Voltage Category (OVC)	short term and continuous		OVC II (5000m)
Over Current Protection (OCP)	auto recovery		120% - 250% of rated I_{OUT}
Class of Equipment			Class I
Isolation Coordination	according to EN 50124-1:2018		VNOM= 250V_{DC}
Isolation Voltage (6)	1 minute	I/P to O/P	4.2kV_{DC}
		I/P to case, OK contact to I/P, O/P and case	2.2kV_{DC}
		O/P to case	1.5kV_{DC}
Isolation Resistance			300MΩ min.
Isolation Capacitance			1200pF typ.
Insulation Grade			reinforced
Internal Clearance	I/P to O/P		5mm
	I/P to PE / O/P to PE		2.5mm

POWER GOOD STANDARD VERSION			
Parameter	Type		Value
Power OK LED	CLS-75-36516	V_{OUT}= >21.6V_{DC}	green
		V_{OUT}= <21.6V_{DC}	light off
Open Collector	CLS-75-36516	V_{OUT}= >21.6V_{DC}	I_{MAX}: 0.5 mA; V_{Max}: 72 V
		V_{OUT}= <21.6V_{DC}	NOK= 0V

POWER GOOD /P VERSION			
Parameter	Type		Value
Power OK LED	CLS-75-36516	V_{OUT}= >21.6V_{DC}	green
		V_{OUT}= <21.6V_{DC}	light off
Power Good			0.9Vout
Alarm	CLS-75-36516	V_{OUT}= >21.6V_{DC}	OK: OK2 connected OK or OK1 not connected OK
		V_{OUT}= <21.6V_{DC}	NOK: OK1 connected to OK or OK2 not connected OK

PEAK LOAD CAPABILITY

Peak power capability supports short power peaks of dynamic loads like motors, relays, storage devices or computer booting sequences. In addition allowing faster charge of load sided capacitors and reliable circuit breaker operation. The peak power rating applies only up to a maximum ambient temperature of +70°C. For Din-rail mounted version no peak power allowed, 75W max. continuous power!

P_{nom} = nominal output power [W]
P_p = peak output power (90W max) [W]
P_r = recovery power (≤60W) [W]
t_1 = peak time (10s max) [s]
t_2 = recovery time (3 x t_1) [s]

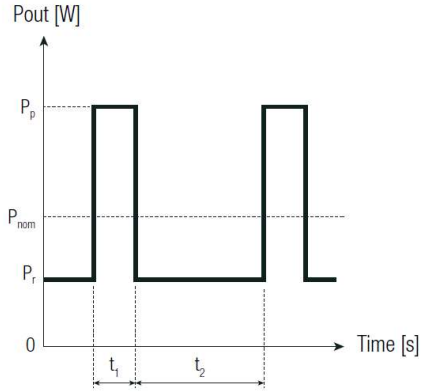
Calculation:

$$t_2 = \frac{(P_{nom} - P_P) \times t_1}{P_r - P_{nom}}$$

Practical Example:

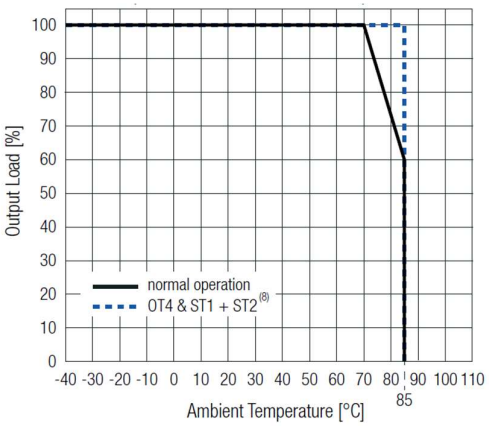
P_{nom} = 75W
P_p = 90W
P_r = 60W
t_1 = 10s

$$t_2 = \frac{(75W - 90W) \times 30s}{60W - 75W} = \underline{30s}$$

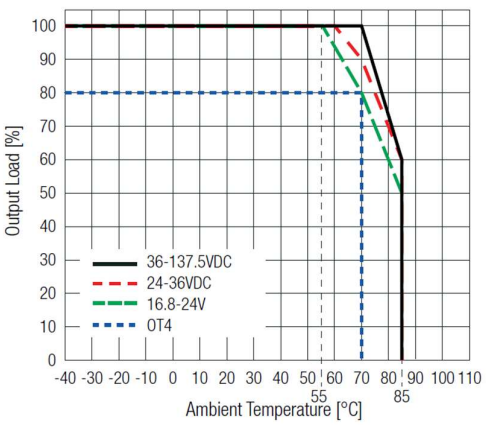


ENVIRONMENTAL (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)			
Parameter	Conditions		Value
Operating Ambient Temperature Range	without derating, normal operation		-40°C to +70°C
	according to EN 50155 class OT4 and extended operating temperature class ST1 & ST2	without derating for 15 minutes max.	-40°C to +85°C
Maximum Baseplate Temperature			+95°C
Temperature Coefficient			0.2%/K
Operating Altitude	according to EN 50124-1:2018		5000m
Operating Humidity	non-condensing		95% RH max.
Conformal Coating	according to EN 50155		Class PC2
Pollution Degree			PD2
IP Rating			IP20
Design Lifetime			20 years
MTBF	according to IEC 61709/ UTE C80-810	T_{AMB}= +40°C	1950 x 10³ hours
		T_{AMB}= +50°C	1400 x 10³ hours
Useful Life Class	according to EN50155:2018 (S1)		L4

Derating Graph (Standard and "**P**" version)



Derating Graph "**D**" Version



The specified operating temperature range -40°C to +85°C (covering OT4, ST1 and ST2) is valid only with conduction cooling to a thermally suitable baseplate (e.g. aluminum or equivalent) of at least 300 × 300 mm and 2.5mm thickness

ENVIRONMENTAL (RAILWAY STANDARDS)		
Parameter	Conditions	Value
Low Temperature start-up test	Temperature: -40°C; Stabilization time 2h	EN 60068-2-1 (Ad)
Dry heat test	Temperature: +70°C; Continuous operational checks time 6h	EN 60068-2-2 (Be) – Cycle A
Low temperature storage test	Temperature: -40°C; Low temperature exposition time 16h	EN 60068-2-1 (Ab)
Cyclic damp heat test	Temperature: +70°C/+25°C; Number of cycles: 2; Time 2x 24h	EN 60068-2-30 (Db)
Simulated long-life testing (Test performed at maximum level for each axis.)	Random Vibration, unit not powered during test Frequency range 5-150Hz with -6db/oct from 20 to 150Hz Vertical axis 5.72m/s² for 5h [ASD 0.964(m/s²)²/Hz] Transverse axis 2.55m/s² for 5h [ASD 0.192(m/s²)²/Hz] Longitudinal axis 3.96m/s² for 5h [ASD 0.461(m/s²)²/Hz]	EN 61373 clause 9, class B Body mounted
Shock testing (Test performed at maximum level for each axis.)	Half-sine shock, unit powered during test; Vertical axis 30m/s² for 30ms Transverse axis 30m/s² for 30ms; Longitudinal axis 50m/s² for 50ms Number of shocks: 18 (3x polarity for each axis)	EN 61373 clause 10, class B Body mounted
Functional random vibration test (Test performed at maximum level for each axis.)	Random Vibration, unit powered during test Frequency range 5-150Hz with -6db/oct from 20 to 150Hz Vertical axis 1.01m/s² for 10min [ASD 0.0301(m/s²)²/Hz] Transverse axis 0.45m/s² 10min [ASD 0.006(m/s²)²/Hz] Longitudinal axis 0.7m/s² 10min [ASD 0.0144(m/s²)²/Hz]	EN 61373 clause 8, class B Body mounted
Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behavior of materials and components	R24 & R25	EN45545-2 Hazard Level HL1 - HL3

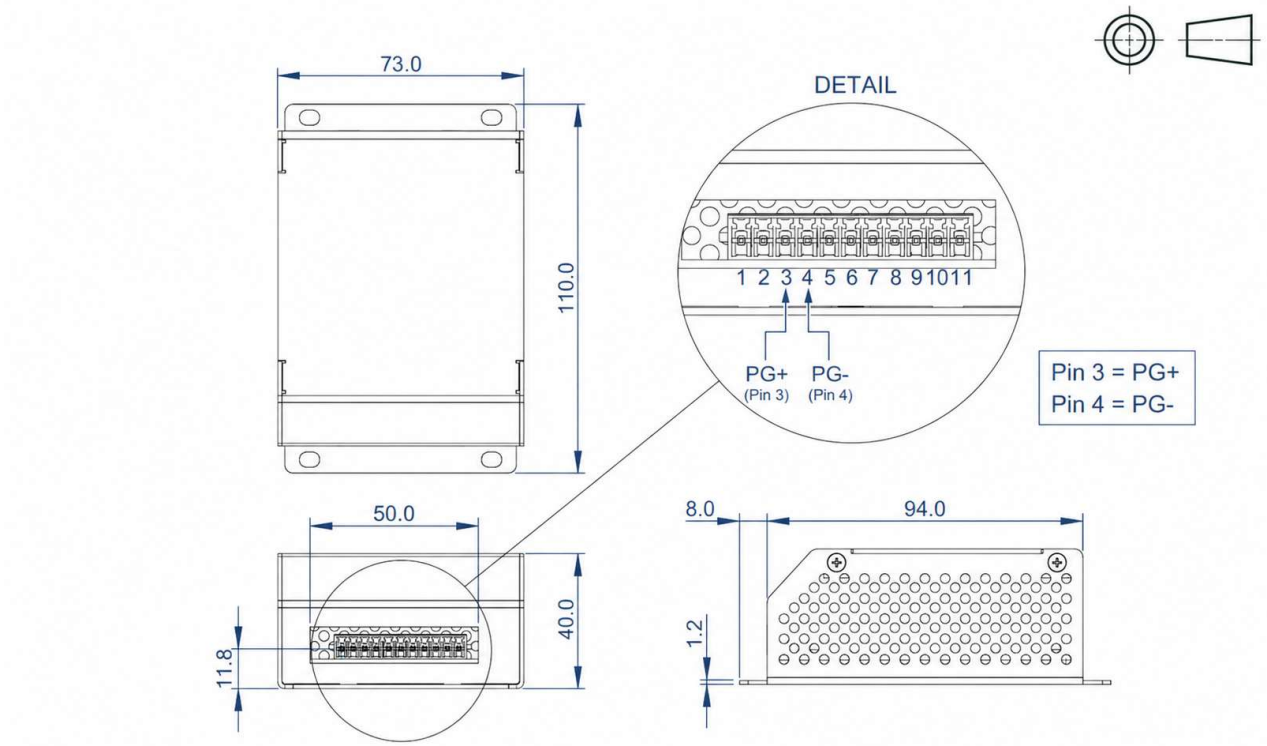
SAFETY & CERTIFICATIONS	
Certificate Type (Safety)	Standard
Audio/video, information and communication technology equipment. Safety requirements	IEC62368-1:2018 3rd Edition EN IEC 62368-1:2020+A11:2020
Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment	EN50124-1
Railway Applications - Electrical Equipment used on rolling stock	EN50155
RoHS2	RoHS 2011/65/EU + AM2015/863

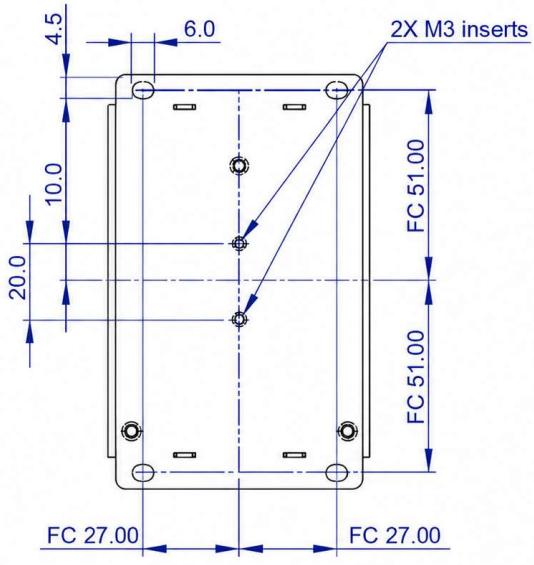
EMC Compliance	Conditions		Standard / Criterion
Railway applications - Electromagnetic compatibility			EN50121-3-2:2016
Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments			EN IEC 61000-6-2:2019
Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments		V_{IN}= 24V_{DC} & 110V_{DC}	EN61000-6-4:2007+A1:2011
ESD Electrostatic discharge immunity test	V_{IN}= 24V_{DC} & 110V_{DC}	Air: ±2, 4, 8kV Contact: ±2, 4, 8kV	IEC61000-4-2:2008, Criteria A EN61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	V_{IN}= 24VDC & 110V_{DC}	20V/m (80-1000MHz) 10V/m (1000-6000MHz)	IEC/EN61000-4-3:2010, Criteria A
Fast Transient and Burst Immunity		DC Power Port: ±2kV DC Output Port: ±2kV	IEC/EN61000-4-4:2012, Criteria A
Surge Immunity	V_{IN}= 24V_{DC} & 110V_{DC}	DC Power Port sym.: ±0.5, 1kV DC Power Port unsym.: ±0.5, 1, 2kV	IEC/EN61000-4-5:2014, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	V_{IN}= 24V_{DC} & 110V_{DC}	DC Power Port: 10Vr.m.s. (0.15-80MHz)	IEC61000-4-6: 2013, Criteria A EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	V_{IN}= 24V_{DC} & 110V_{DC}	30A/m, 50/60Hz	IEC61000-4-8:2009, Criteria A EN61000-4-8:2010, Criteria A
Railway applications - Electromagnetic compatibility	V_{IN}= 24V_{DC} & 110V_{DC}		EN50121-3-2:2016+A1:2019
Technical rules for electromagnetic compatibility: verification of the radio compatibility of railway vehicles with railway radio services.	V_{IN}= 24V_{DC} & 110V_{DC}		EMV 06:2019

DIMENSION & PHYSICAL CHARACTERISTICS		
Parameter	Type	Value
Material	case	aluminum
Dimension (LxWxH)	standard version	110.0 x 73.0 x 40.0mm (4.33 x 2.87 x 1.57 inch)
	P version	112.0 x 73.0 x 40.0mm (4.40 x 2.87 x 1.57 inch)
	D version	110.0 x 73.0 x 49.0mm (4.33 x 2.87 x 1.92 inch)
	PD version	112.0 x 73.0 x 49.0mm (4.40 x 2.87 x 1.92 inch)
Weight	standard version	320g typ. (0.71 lbs)
	P version	328g typ. (0.72 lbs)
	D version	331g typ. (0.73 lbs)
	PD version	339g typ. (0.75 lbs)

DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing S Version (mm)





Connector Information

DEGSON 15EDGK-3.5-11P-11-002AH

#	Function	#	Function
1	$+V_{OUT}$	7	PE
2	$-V_{OUT}$	8	NC
3	+PG	9	$+V_{IN}$
4	–PG	10	$-V_{IN}$
5	TRIM	11	RC
6	NC		

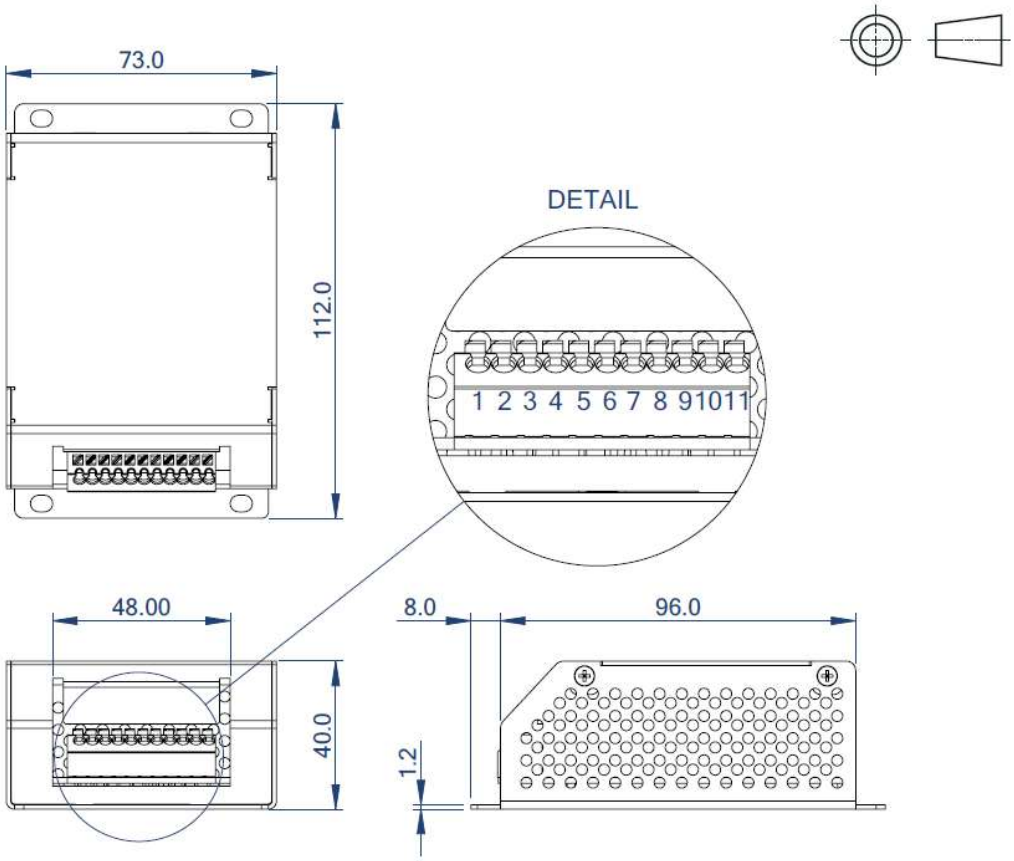
Compatible Connector
not included

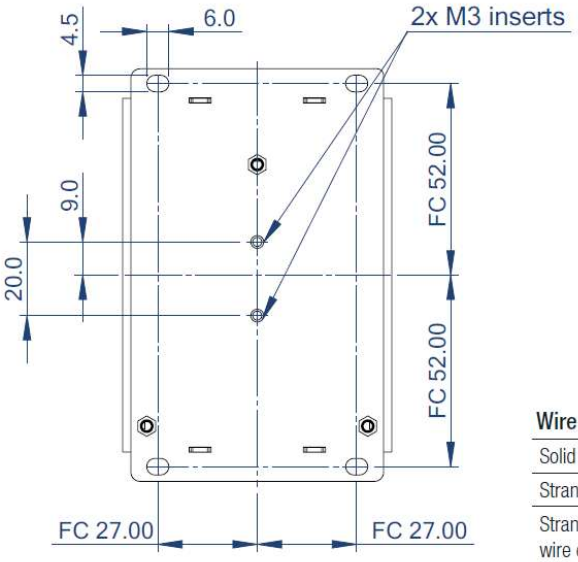
Degson 15EDGK-3.5-11P

Tolerances:
xx.x = ±0.5mm
xx.xx = ±0.25mm
FC = fixing centres

The M3 inserts can be used for DIN-rail clip (max. penetration= 2.5mm)

Dimension Drawing P Version (mm)





CAGE CLAMP®
(Wago 250-211)

#	Function	#	Function
1	$+V_{OUT}$	7	PE
2	$-V_{OUT}$	8	NC
3	OK	9	$+V_{IN}$
4	OK1	10	$-V_{IN}$
5	OK2	11	RC
6	NC		

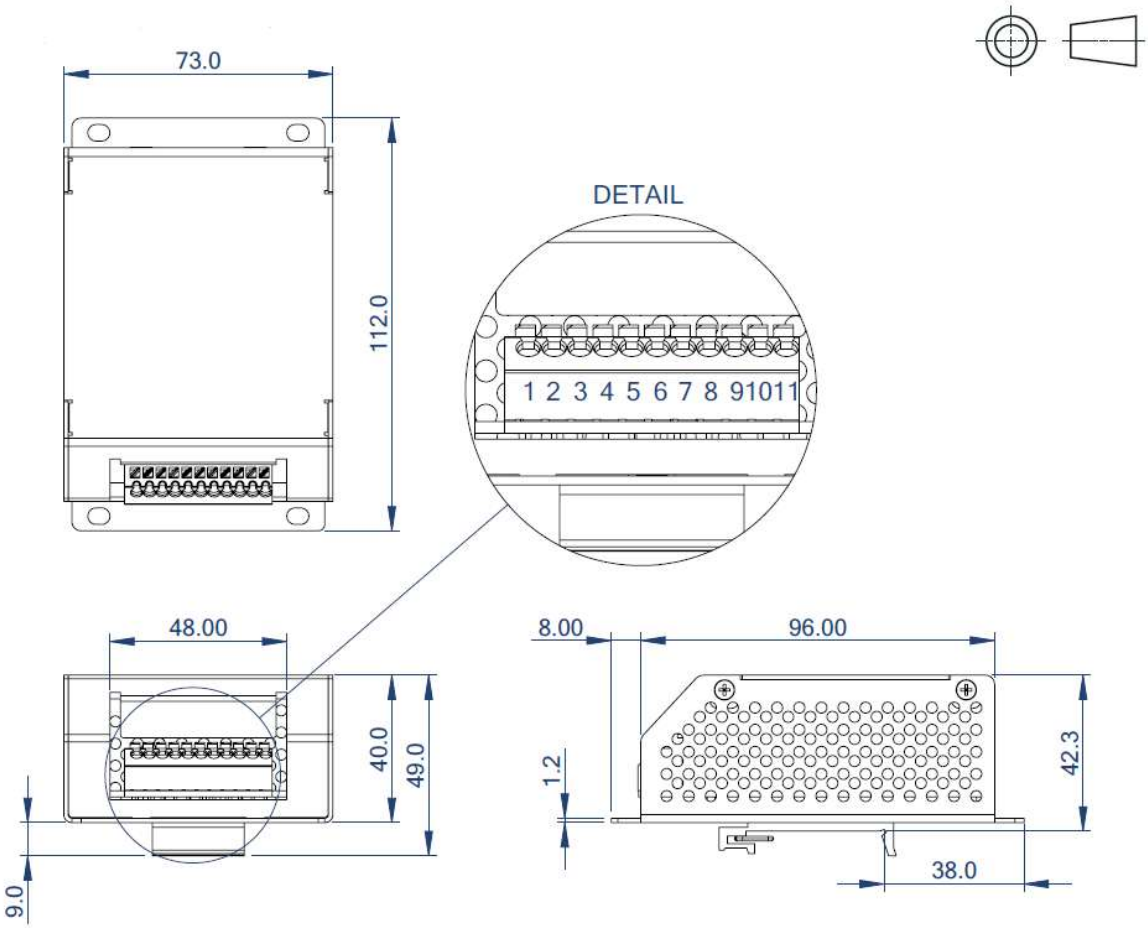
Wire cross section

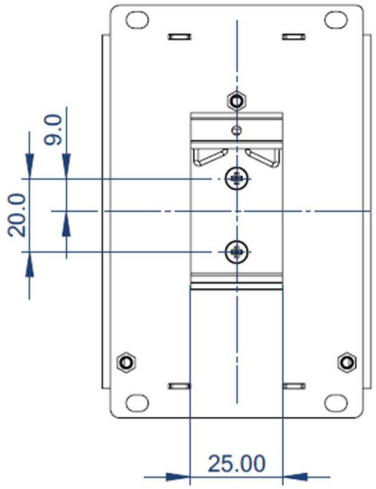
Solid conductor	0.2-1.5mm² / 24-16 AWG
Stranded conductor	0.2-1.5mm² / 24-16 AWG
Stranded conductor: wire end ferrule with plastic collar wire end ferrule without plastic collar	 0.25-1.0mm² 0.25-1.0mm²
Stripping length	8.5-9.5mm / 0.33-0.37 inch

The M3 inserts can be used for DIN-rail clip (max. penetration= 2.5mm)

Tolerances:
xx.x= ±0.5mm
xx.xx= ±0.25mm
FC = fixing centers

Dimension Drawing PD Version (mm)





CAGE CLAMP®
(Wago 250-211)

#	Function	#	Function
1	$+V_{OUT}$	7	PE
2	$-V_{OUT}$	8	NC
3	OK	9	$+V_{IN}$
4	OK1	10	$-V_{IN}$
5	OK2	11	RC
6	NC		

Wire cross section

Solid conductor	0.2-1.5mm² / 24-16 AWG
Stranded conductor	0.2-1.5mm² / 24-16 AWG
Stranded conductor: wire end ferrule with plastic collar wire end ferrule without plastic collar	 0.25-1.0mm² 0.25-1.0mm²
Stripping length	8.5-9.5mm / 0.33-0.37 inch

Tolerances:
xx.x= ±0.5mm
xx.xx= ±0.25mm
FC = fixing centers