DEIF A/S

Load sharing relays

Types DGC-1TF, DGC-1TB

4921240017C

DGC-1TF

DGC-1TB

- *For control of diesel or turbine generators*
- *Direct control of mechanical speed governor*
- *Universal for:*
  - *isochronous mode with load sharing*
  - *"speed droop" mode with load sharing*
- *Flush or base mounting*

CE

General information

The "Diesel Generator Controller" unit consists of a DEIF standard TRANSAL PI-step controller provided with a purpose-designed input module. The TRANSAL is CE marked for residential, commercial and light industry plus industrial environment, and is available in 2 mechanically different versions:

DGC-1TF: For flush mounting in the panel front **DGC-1TB**: For base mounting inside the panel

Application

DGC-1T is applicable in conjunction with all types of engines equipped with a mechanical speed governor, provided the "set point" of this can be set by means of a servomotor with 2 directions of rotation.

Note: the following setting in conjunction of the rate of change of the frequency is recommended:

To ensure stable control:	**Max. 0.2…1% of rated frequency per s**
If an extraordinarily heavy fly-wheel is applied:	**Max. 0.1…0.2% of rated frequency per s**

Terms applied

The following abbreviations are applied in the below text:

"DGC-1" referring to the 2 above mentioned TRANSAL models.

"DG" referring to diesel generators, other types of internal combustion engines and turbine generators.

Possible connections

1 DGC-1 is applied per generator. The DGC-1 is provided with 2 output relays, controlling the servomotor of the speed governor. The DGC-1 is normally controlled by 1 or 2 DC signals (-10...0...10V) fed by external measuring transducers, however, for special connections a third DC signal - a control voltage of -10...0...10V is applied.

By varying the connection of the input terminals the DGC-1 can control a generator running in all possible modes of operation and combinations of these.

Measurement of power

The power of each generator is measured using a watt transducer, and the DC output of this controls input "P" of the associated DGC-1 unit.

Measurement of frequency

The bus bar frequency is measured using a frequency transducer, common to all generators, and the DC output of this controls input "O" of those DGC-1 controllers, for which the frequency affects the control of the generators.

Modes of operation

2...n off DG in isochronous mode with load sharing
2...n off DG in "speed droop" mode with load sharing

"Load sharing" means equal sharing in percentage of active load between the generators, i.e. the load is shared equally, even though the generators vary in size. If a DG is temporarily derated, the set point on the main scale of the associated DGC-1 is reduced accordingly, and the load sharing will subsequently still be correct.

Inputs and outputs

Terminal "C"	Is common to all analog signals
Input "P"	-4...0...10V DC (R_i: 10kΩ) (non-inverting) Is always connected to the output of the associated watt transducer
Input "O"	0...±10V DC (R_i: 20kΩ) (non-inverting) Is connected to the output of the common frequency transducer in modes: 1. Isochronous 2. "Speed droop"
Input "A"	0...±10V DC (R_i: 18kΩ) (inverting) Is normally short-circuited to terminal "C", however, it may be connected to an additional control voltage for e.g. external adjustment.
Input "I"	The voltage of this terminal is the "reference voltage" of the controller, which for: 1. "Speed droop" is connected to terminal "C" 2. Isochronous mode is connected to a common parallelling line (after having been synchronised to other D.G.'s)
Difference output "B":	0...±1V DC (load: min. 1kΩ). This output signal expresses the deviation of the actual load from the correct load of the generator. ±1V deviation corresponds to ±20% of 10V.
Relay outputs:	The MIN. relay (terminals 2-1-3) controls the speed governor of the diesel generator upwards, the MAX. relay (terminals 12-11-13) downwards, when load or frequency deviations exceed the "deadband". 1 change-over switch per relay.

Settings

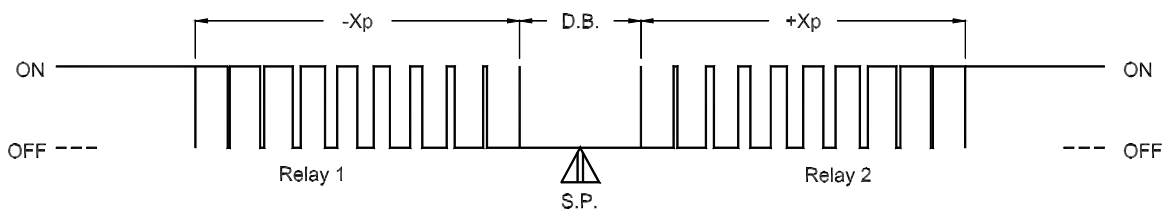
Main scale (S.P.):	Set to 100% of P_r corresponding to input voltage 8.00V. If the generator is derated, S.P. is set directly to the actual percentage derating. May be locked after adjustment. A proportional increase of x_p may be needed to ensure stable control.
"Deadband" (D.B.):	The range within which no control signals are transmitted. Standard setting: ±2% of 10V. Adjustment range: ±0.5...±3% of 10V. See below.
"Proportional band" x_p scale (0...50%):	This is the range where the pulse control takes place. Within this range the pulse ratio, i.e. T_{ON}/T_{OFF} will be determinated by the devaition of the measured signal from the set point. Outside the proportional band the relevant relay will be continuously ON. x_p determines the amplification in the control loop and is independent of T_N.
"Pulse length" T_N scale (0...10):	This is primarily determined by the T_N adjustment but it is also affected by the adjustment of x_p. When x_p rises, the $T_{ON} + T_{OFF}$ time is shortened, but this has a favourable effect when stopping continuous fluctuations in the control process.

Possible settings	**T_N (pulse length)**	**DB (dead band)**	**x_p (proportional band)**
	"VERY SLOW"	±1...6% of ΔS (scale length)	0...±10% and 0...±50%
	"SLOW"	±0.5...3% of ΔS (scale length)	0...±10% and 0...±50%
	"FAST"	±0.5...3% of ΔS (scale length)	0...±10% and 0...±50%
On delivery:	"SLOW"	±0.5%	0...±10%

By adjusting T_N and x_p on the scale front the controller can be adapted to most control loops.

Contacts

Aux. supply	**Relay**	**Contact type**	**Relay R1**	**Relay R2**	**Contacts**	**LED**
ON	ON	A Normally de-energised	1-3	11-13	Closed	ON
			1-2	11-12	Open	
ON	OFF	A Normally de-energised	1-3	11-13	Open	OFF
			1-2	11-12	Closed	
OFF	OFF	A Normally de-energised	1-3	11-13	Open	OFF
			1-2	11-12	Closed	



Calibration of watt transducers

Standard calibration
Output 8.00V DC corresponds to the rated power of the generator (P_r).

Calibration of frequency transducer

Available with variable or fixed calibration. f_N = 50Hz or 60Hz (always to be specified in order)
Variable calibration
For speed droop mode: 2..4% and f_N = 0...100% of P_r
For isochronous mode: $f_O = f_N$ ±1.5Hz. Range: f_O ±1.25...±10Hz Calibrated using two 20-turns trimming potentiometers after the cover of the transducer has been removed.
Fixed calibration
For speed droop mode: 3% or 4%* and f_N = 75%* of P_r. Adjustment NOT possible. See page 7.
For isochronous mode: $f_O = f_N$. Range: f_N ±5Hz*. Readjustment possible (see “Variable calibration”). *) DEIF standard, other data on request.
Variable response time
Frequency transducers are on request fitted with a trimming potentiometer for adjustment of the response time of the transducer. (T = time constant = 0.4...1 s). If heavy load variations often occur, this potentiometer is adjusted until the DGC-1 controllers transmit fewest possible control pulses. Standard setting: T = 0.4 s.

Connection diagrams

These consist of a “main diagram” (see page 6) and 2 detail diagrams (fig. 1…2) with text.

The main diagram shows how the DGC-1 in principle is connected to the external transducers and to a common synchronising unit, the DEIF fully automatic synchronising relay type FAS-2N.

The "stand-by selector" is only shown schematically, as this change-over function may be carried out in several ways.

The centre of the main diagram (framed by the dotted lines) is a detail diagram similar to the 2 other detail diagrams.

Electrical function (fig. 1…2)

Fig. 1	V_I changes proportionally to the average load, and is the reference voltage of the DGC-1. The DGC-1 will continue controlling, until $V_P/2 = V_I$ and $V_O = 0$.
Fig. 2	V_I is the reference voltage of the DGC-1. The DGC-1 will thus continue controlling, until $V_P = V_O$, however, with opposite polarity, i.e. the sum of the 2 inputs is zero, when the controller is balanced.

Isochronous mode with load sharing (standard connection)

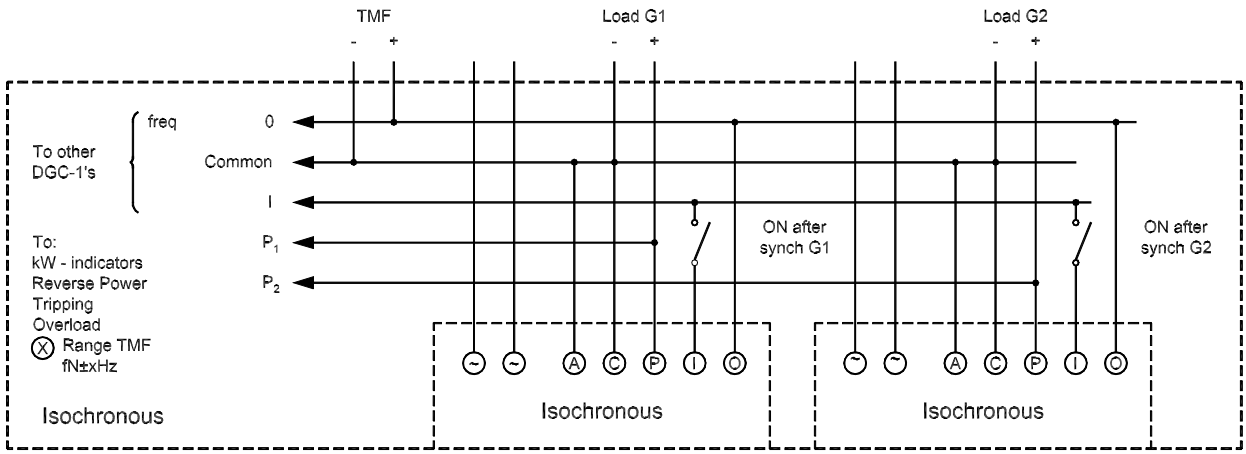


Fig. 1

When the "master" generator has been started and connected to the bus bars, the DGC-1 controls it towards the rated frequency.

When a standby generator has been started, the synchronising relay (FAS-2N) automatically connects this to the bus bars, and by means of an auxiliary relay controlled by the generator circuit breaker (“GB”) the following functions are carried out:

1. The FAS-2N is disconnected ("RESET")
2. Supply voltage of the DGC-1 is connected
3. "Input I" for the DGC-1 is connected to a parallelling line

The load is then shared automatically between the generators, and the frequency is simultaneously kept to the rated frequency value.

"Speed droop" mode with load sharing (standard connection)

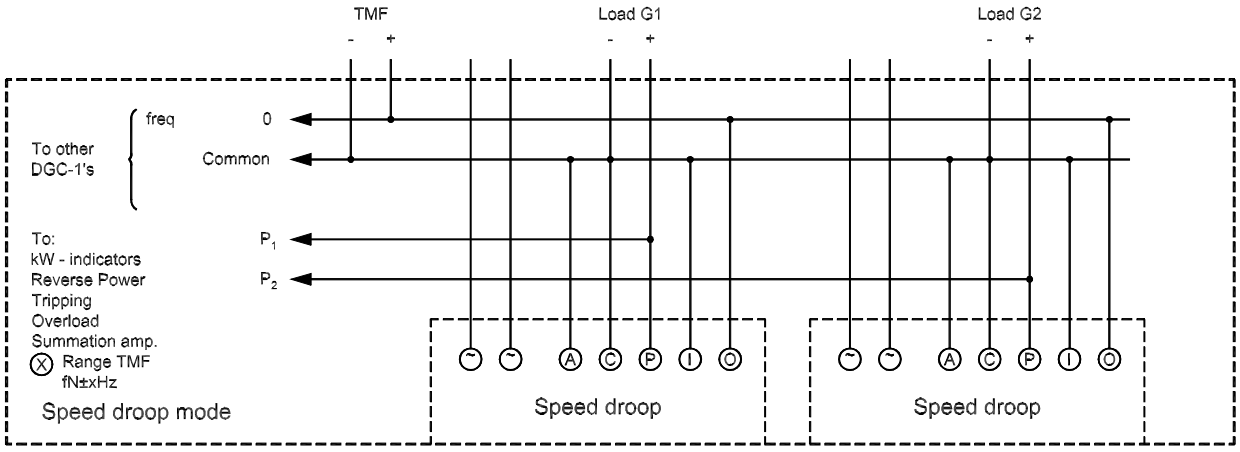


Fig. 2

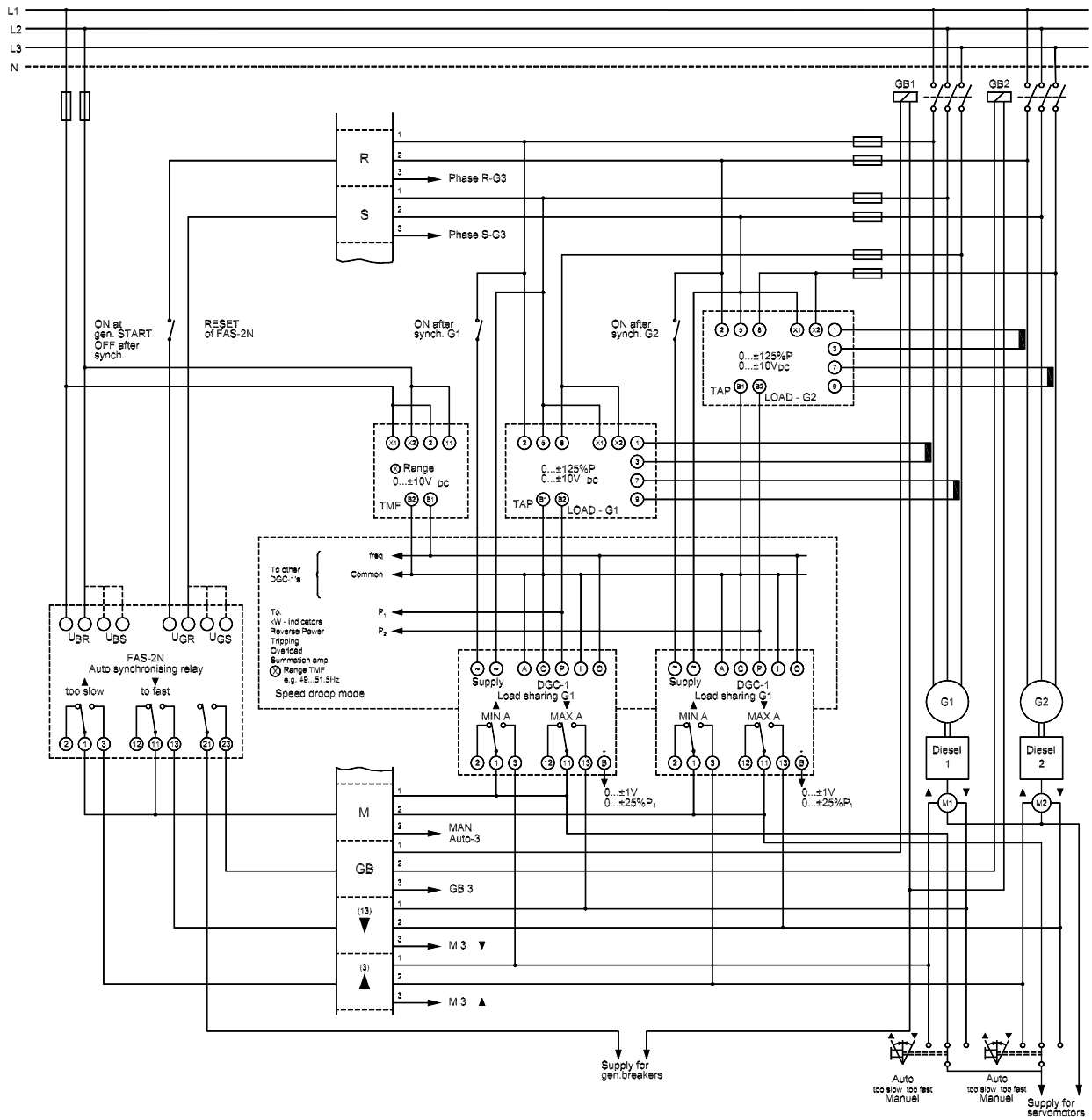
When the “master” generator has been started and connected to the bus bars, the DGC-1 controls it towards the speed droop frequency value.

When a standby generator has been started, the FAS-2N automatically connects this to the bus bars, and by means of an auxiliary relay controlled by the generator circuit breaker (“GB”), the following functions are carried out:

1. The FAS-2N is disconnected (“RESET”)
2. The supply voltage of the DGC-1 is connected

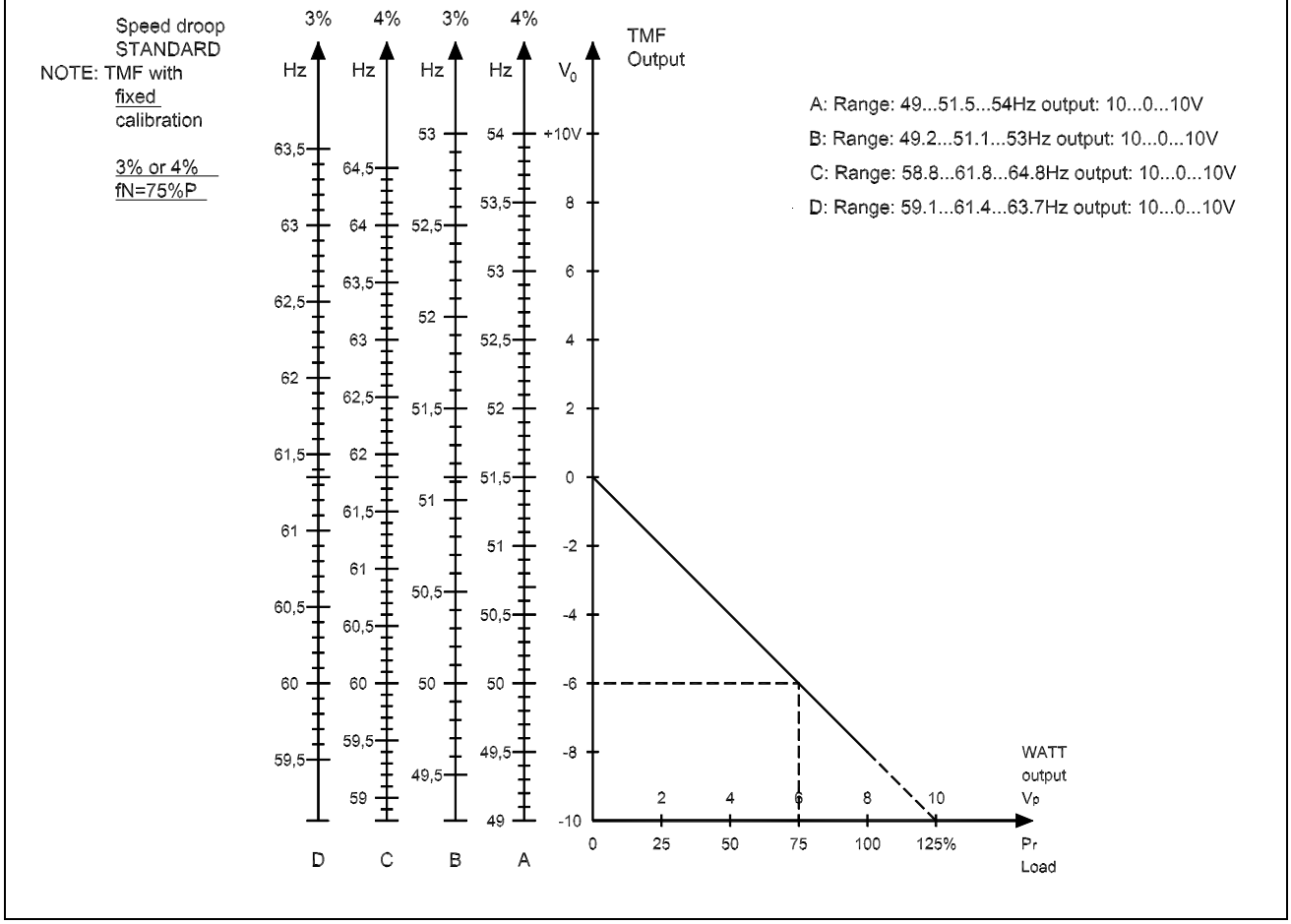
The load is then automatically shared between the generators, and the frequency is simultaneously changed to the correct value according to the speed droop line at the actual load.

Wiring diagram



DGC-1TF/DGC-1TB

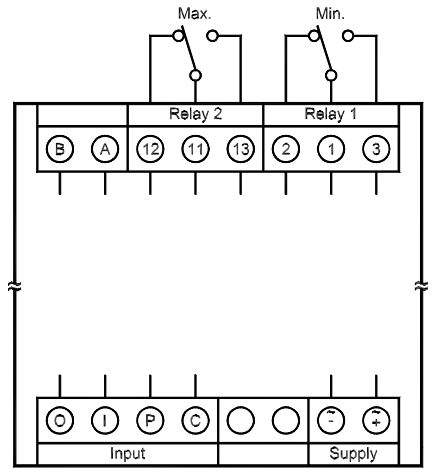
Speed droop standard



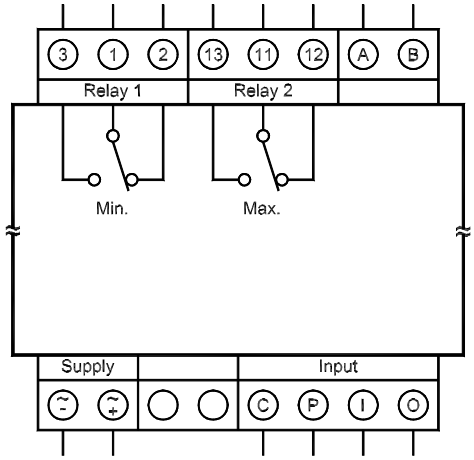
Technical specifications

Accuracy:	Between input and difference output: ±0.5%. Between input and set point: ±1%	
Temperature:	-10...55°C (nominal), -25...70°C (operating), -40...70°C (storage)	
Temperature drift:	Max. 0.15% of F.S. per 10°C	
Galvanic separation:	Between input and output	2,2kV - None
	Between input/output and relay contacts	2,2kV - 50Hz - 1 min.
	Between input/output and auxiliary voltage	2,2kV - 50Hz - 1 min.
Auxiliary voltage (U_N):	24-48-57.7-63.5-100-110-115-127-220-230-240-380-400-415-440-480V AC ±20% (40...500Hz).	
Aux. voltage drift:	Max. 0.1% for ΔU_N. Consumption: approx. 6VA.	
Relay contacts:	1 change-over contact per relay. 250V-2A-400VA (AC), 250V-2A-50W (DC). At resistive load: 2 x 10^6 change-overs. Mechanical life: 20 x 10^6 change-overs.	
Climate:	HSE, to DIN 40040.	
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-3.	
Connections:	Max. 4 mm^2 (single-stranded). Max. 2.5 mm^2 (multi-stranded).	
Materials:	All plastic parts are self-extinguishing to UL94 (V0).	
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529.	

Connections



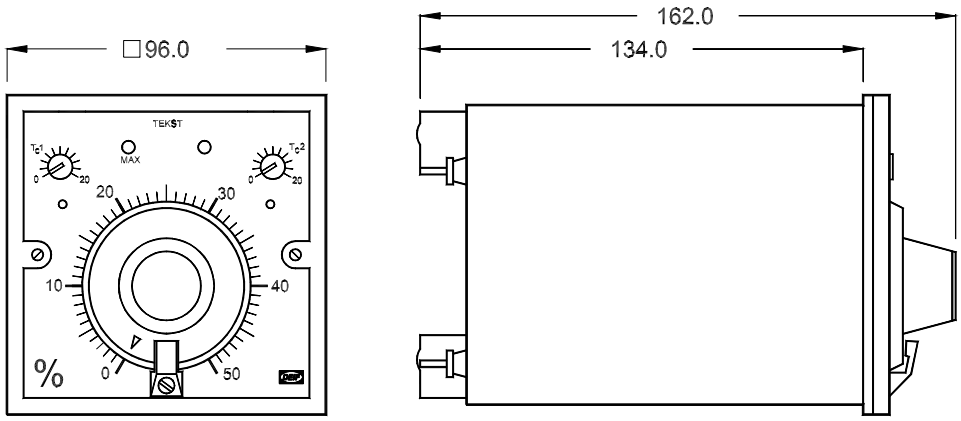
DGC-1TF



DGC-1TB

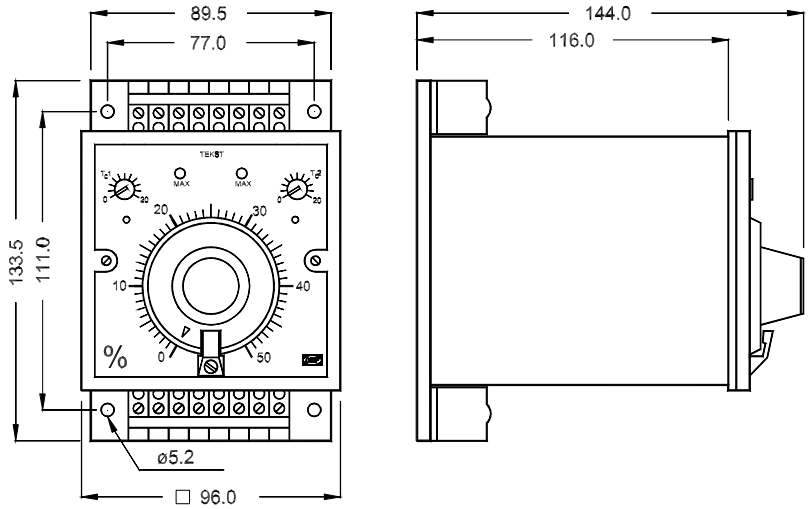
Dimensions

All dimensions in mm



DGC-1TF Weight: approx. 1 kg

All dimensions in mm



DGC-1TB Weight: approx. 1 kg

Order specifications

	Type	**Auxiliary voltage**
Example:	DGC-1TF	400V AC

Due to our continous development we reserve the right to supply equipment which may vary from the described.

***DEIF A/S**, Frisenborgvej 33*
DK-7800 Skive, Denmark

Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com