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SmartAmp Charge Amplifier

Type 5049A...

with Switching Point Optimization During Injection Molding

The SmartAmp is integrated into injection molding machines together with mold cavity pressure sensors, and is used to monitor and control the injection molding process. Automatic switching point optimization is provided for the injection molding of thermoplastic materials.

- Automatic switching as soon as the cavity is full
- Remote controlled measuring range switching
- Rugged case, vibration-resistant construction
- Suppression of noise voltages of up to ±4 V between input and output mass
- CE-compliant

Description

The single-channel SmartAmp Type 5049A… has two remote controlled measuring ranges and can be used with all directly measuring Kistler quartz sensors for mold cavity pressure.

The SmartAmp contains a charge amplifier with extremely high insulation resistance.

The differential input circuit ensures that potential differences of ±4 V between input and output, which occur in an industrial environment, cannot cause interference.

Optocouplers electrically isolate individual operation of the functions: «Switch to Operate» and «Select Range II». An unstabilized d.c. voltage of 18 … 30 V is sufficient for the power supply and the current consumption is approx. 60 mA.

Three modifications exist: Y33, Y36 and Y40. With these modifications, a change in the pin connections is necessary in order to retain the type and number of poles of the connector.

Application

The SmartAmp is designed for injection molding machines for automatic switching from the injection to the holding pressure phase. It can be easily integrated in the machine control system. The switching point optimization is possible only by using the directly measured mold cavity pressure, because only this parameter constitutes a significant characteristic for volumetric filling of the cavity. Neither the hydraulic pressure nor the nozzle pressure are suitable for this.

The mold cavity pressure must be measured with a sensor fitted near the gate. The SmartAmp determines the optimum switching point from the change in the gradient of the rise in pressure. Fluctuations in temperature and viscosity of the melts are thus automatically compensated. Switching takes place neither too early (distorted moldings) nor too late (moldings with high internal stresses).

The starting up of a new production as well as the optimization of new molds is considerably simplified by the automatic learning phase integrated in the SmartAmp. To prevent overinjection of the mold in every case, switching during the first shot is subjected to fixed programming (in Range I to approx. 5 % FS and in Range II to approx. 10 % FS). In the Y40 modification, the switching pressure is limited to approx. 100 bar with the first shot in both measuring ranges by appropriate sensitivity input selection and by using appropriate sensors (with sensitivities of approx. -9,4 pC/bar or approx. -2,5 pC/bar).

The SmartAmp determines the optimum switching point shot by shot in real time thereby compensating for process fluctuations.

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Technical Data

Charge amplifier

Measuring Range I		
adjusted to 5049A22x	pC	±20'000
Measuring Range II		
Ratio 5049A22x	pC	±5'000
Range I/Range II		4
Drift (Operate)	pC/s	<±0,05
Reset/Operate transient	pC	≤±1
Signal polarity Positive output voltage represents negative input charge		
Permissible voltage between sensor low and output/supply GND	V	±4
Noise signal suppression between sensor low and output/supply GND (0 ... 1 kHz)	dB	>50
Maximum input signal without damage		
Voltage	V	<±10
Charge	pC	<±150'000

Instant output (Output)

Error	%	<±1
Zero point error (Reset)	mV	<±10
Output voltage	V	±10
Output voltage limitation	V	>11
Output current	mA	<±5
Output resistance	Ω	10
Frequency range		
Drop -5 %	kHz	0 ... <3,5
Drop -3 dB	kHz	0 ... <10
Output noise signal (0,1 Hz ... 1 MHz)	mV_{pp}	<10

Automatic switching point optimization

Output	Photo MOS relay	
Current load	mA	<100
max. resistance when switched on	Ω	<50

Control inputs for Reset/Operate & Range II

Electrically isolated inputs via optocouplers		
Actuation voltage	V DC	3 ... 45
Current consumption	mA	0,3 ... 4,5

Power supply

Supply voltage	V DC	18 ... 30
Current consumption (without load)	mA	<60

General data

Temperature range		
Operating temperature range	°C	0 ... 60
min./max.	°C	-40 ... 80
Case material (The case is connected to the sensor/ supply GND via an R/C network)	Pressure die cast aluminum	
Degree of protection according to DIN 40050 (connector fitted, TNC input)	IP	65
Vibration resistance Test conditions: 20 ... 2000 Hz in 2 min. continuous operation, 8x within 16 min.	g_p	10
Shock resistance (during 1 ms)	g	<200
Connections: supply, signal outputs and control outputs	Type	Binder connector, 14-pins
Connection for sensor 5049Axx1	Type	TNC neg.
Recommended installation position: Perpendicular, connections downward		
Weight	g	≈250
Modification Y36 Current output	mA	4 ... 20
Modification Y33 Test function for charge amplifier		
Modification Y40 Input sensitivity Initial fixed switching Range I at Range II at	 %FS %FS	 ≈5 ≈20

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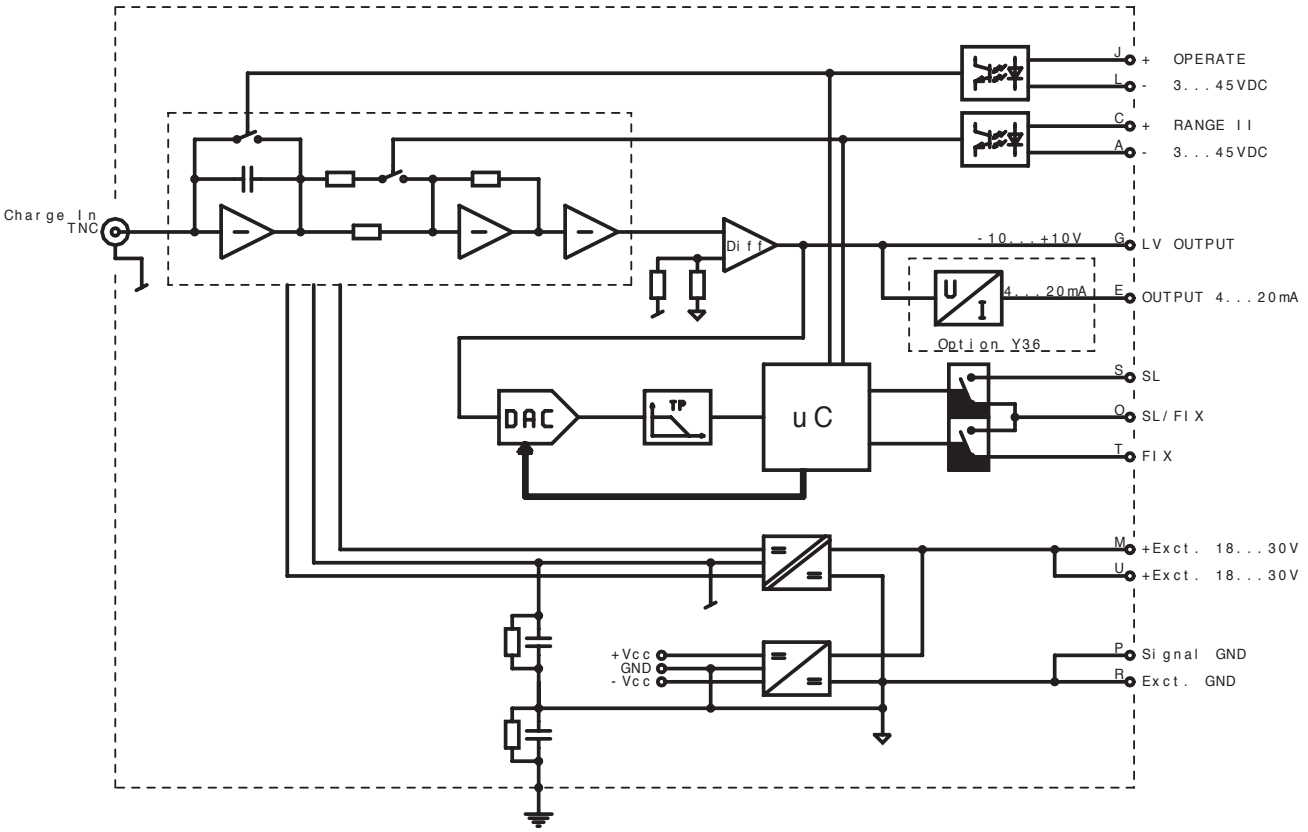

Accessories Included	Art. No.
• Screw M4 x 16	6.120.013
• Spring washer	6.230.063
• Cable connector 14-pole	1500A61

Optional Accessories	Type
• Connecting cable for connection to machine	1477A5
• Coupling BNC neg. - TNC pos.	1709
• Connecting cable for 5049/amplifier interface (Type 5613) for signal processing with Sico (Type 2853) or PICO (Type 2859)	1200A9

Ordering Key

SmartAmp **5049A** □□□

Range I (calibrated) 20'000 pC	**2**
Ratio 4	**2**
Charge input TNC neg. (for IP 65)	**1**

The above ordering code can be supplemented with:

... Y33 Test function for charge amplifier & Exct 14,1 … 17,2 V

... Y36 Additional current output 4 - 20 mA

... Y40 Input sensitivity
Initial fixed switching
in Range I at approx. 5% FS and
in Range II at approx. 20% FS

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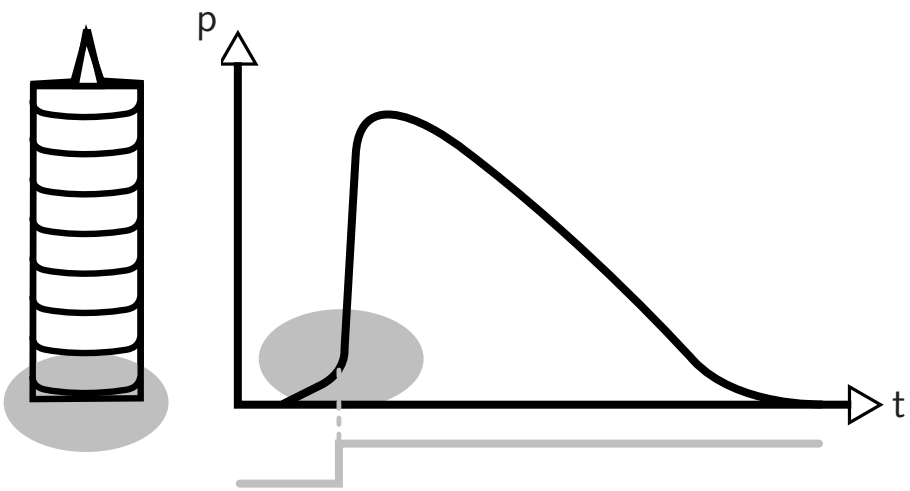
Optimization of the switching point with the aid of the mold cavity pressure:

Traditional: Manual optimization

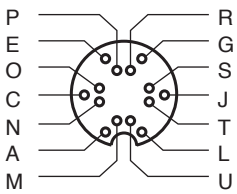
1 Set holding pressure to zero.
2 Set injection speed.
3 Intentionally select too low a switching pressure, e.g. 50 bar.
4 Carry out a test shot and determine the degree of volumetric filling.
5 Increase the switching pressure, e.g. to 70 bar.
6 Carry out a further test shot and ascertain the degree of volumetric filling.
7 Repeat steps 5 and 6 until the complete volumetric filling is achieved.
8 When the switching pressure for the complete volumetric filling has been determine (e.g. at 112 bar), the switching point is optimized and only now can the holding pressure be set.
9 On every occasion when a parameter (e.g. the injection speed or the temperature of the melt) is changed, the entire optimization process must be restarted beginning at Step 1. If a parameter, such as the viscosity of the melt, changes during production, the molding quality will fluctuate because of the fixed switching point.

New: Injection molding with SmartAmp

1 Set a sufficiently large shot size (cushion min. 10 mm).
2 Holding pressure: set approx. 2/3 of the anticipated holding pressure.
3 Optimize the remaining parameters as usual.
4 Production: The SmartAmp switches automatically at volumetric filling – i.e. at the optimum moment. Optimum switching also takes place when other parameters are changed later (e.g. the injection speed or melt temperature) or when parameters such as the viscosity of the melt change during production.



Automatic detection of the switching point as soon as the cavity volume is full.



P:	SignalGND	R:	ExctGND
E:	NC	G:	SignalOutput±10V
O:	FIX/SL	S:	SL
C:	+RangeII	J:	+Operate
N:	NC	T:	FIX
A:	-RangeII	L:	-Operate
M:	+Exct18…30V	U:	+Exct18…30V

Pin contacts

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