BOLDER GmbH
AUTOMATION

GraviMaster 2704

Gravimetric Control for Extrusion and Blending

Throughput

kg/m control

Co-extrusion

Blending

Integration

- Gravimetric (loss-in-weight)
- Operating overview
- PLC included
- Modular hardware
- Interfaces

Reliability

- Simple to use
- Reliable operation
- Diagnostic functions
- Compact mounting
- Electronics from wide range products

Efficiency

- Higher product quality with less material usage
- Lower losses due to quicker start-up
- Working point change supported in automatic mode

Weight-per-meter control

Haul-off set-point

Line speed

GraviMaster 2704

Output variable, extruder speed
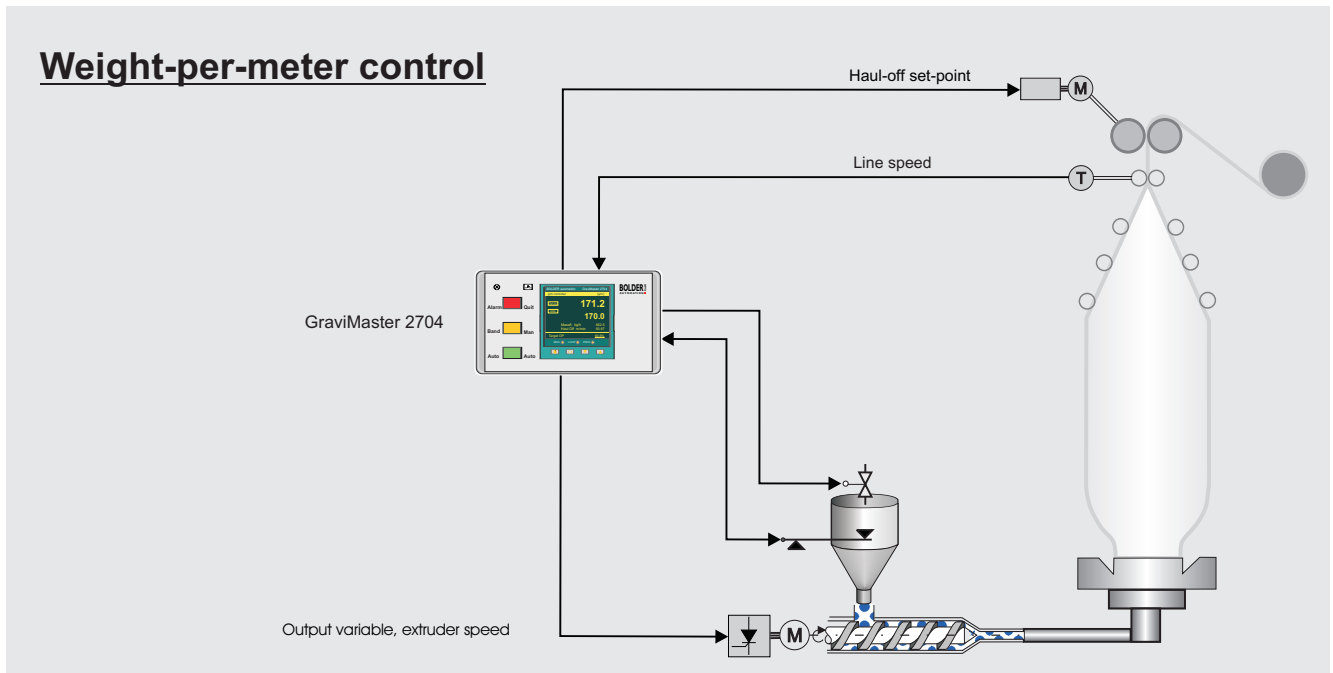
Weight-per-meter control via the extruder (see above)

Start-up of the extruder and haul-off is done independently in set mode. The weight-per-meter control can be switched on if the line has been adjusted and the working points coordinated with each other.

Run-up to production speed is supported by a ramp function that drives the extruder proportionally in a synchronous mode.

Control of the weight-per-meter functions independently of the working point and adaptively.

Weight-per-meter control via the haul-off

The extruder is driven independently and mostly with a constant speed. In this operating mode the heat regulation of the extruder should not be changed.

Deviations of the weight-per-meter are balanced out by the line speed. The adaptive control gently corrects deviations in an optimal time.

A selectable alarm strategy provides for a reliable control mode and for manual operation fulfilling the application requirements.

Throughput control

for

pellets

powder

regrind material

GraviMaster 2704

set-point extruder speed
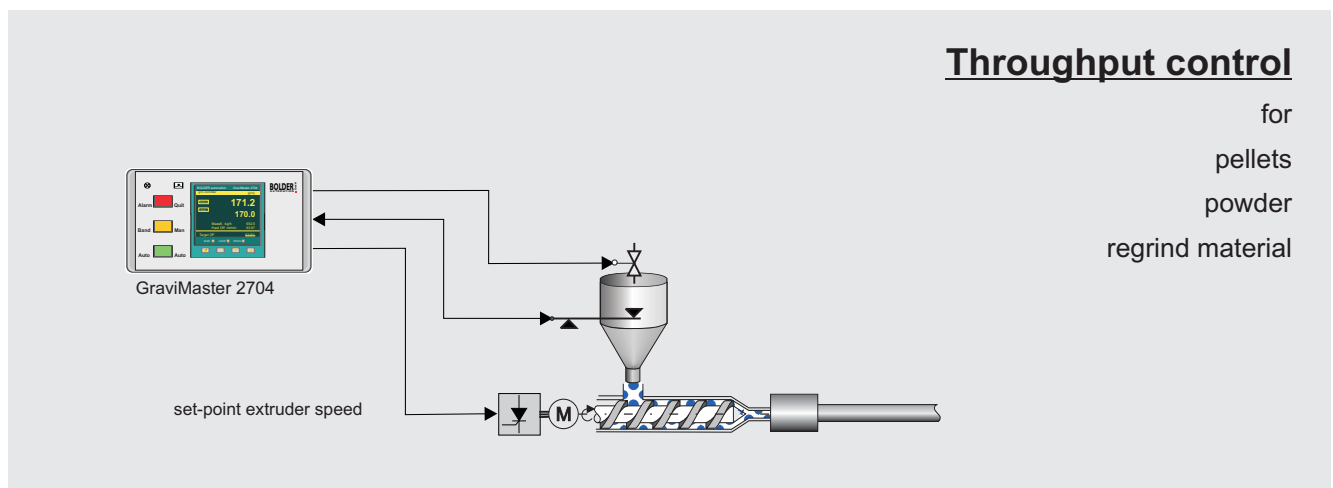
Throughput control of the extruder

Throughput control of the extruder is a configurable basic function of the GraviMaster. To start with the screw speed is set by hand. If the throughput is within tolerance limits the system can be driven in automatic mode. The function is comparable with an electronically controlled potentiometer.

The automatic/manual strategy is selectable:

- manual switch-over to automatic mode within the tolerance band.
- manual switch-over to automatic mode within or outside the tolerance band.
- self-acting switch-over to automatic mode within the tolerance band
- set-point tracking in manual mode

Blend feeding

Applications:

- free-flowing main component

- **starved** feeding of extruder

- feeding with level control

- Start-stop operation

- self-coloring with gravimetric
  metering
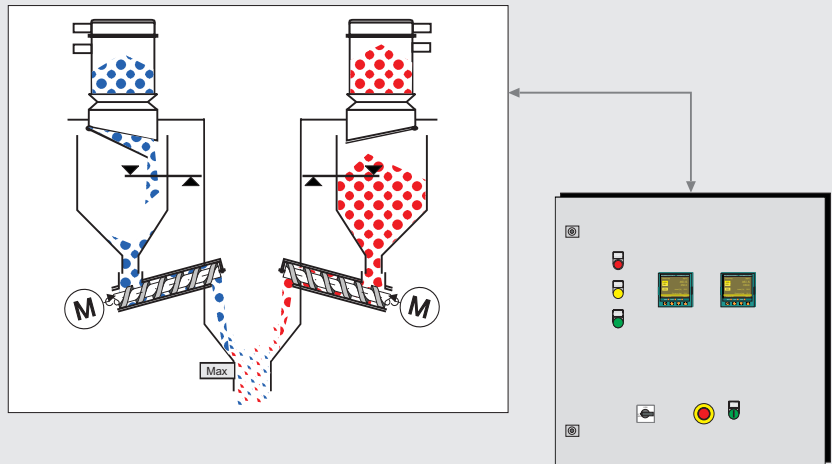
Blend feeding

With blend feeding the throughput of each component is measured with a GraviMaster and the blend controlled via the feeders according to the throughput settings. The conveyance control can be integrated in the GraviMaster.

Since feeding is arranged in a modular form the process-specific functions are allocated to the first components.

Alternatively, the individual instruments can also be connected via a fieldbus interface to a supervisory PLC.

Self-coloring with gravimetric metering

An important function with feeding is the self-coloring directly on the extruder of neutral material with masterbatch.

Masterbatch is fed in at the side into the main stream of the neutral material. The setpoint takes into consideration the measured throughput of the main components, or it is calculated from the screw speed and the specific characteristics of the extruder.

With weight-per-meter control masterbatch feeding can be integrated or supplemented by an additional instrument.
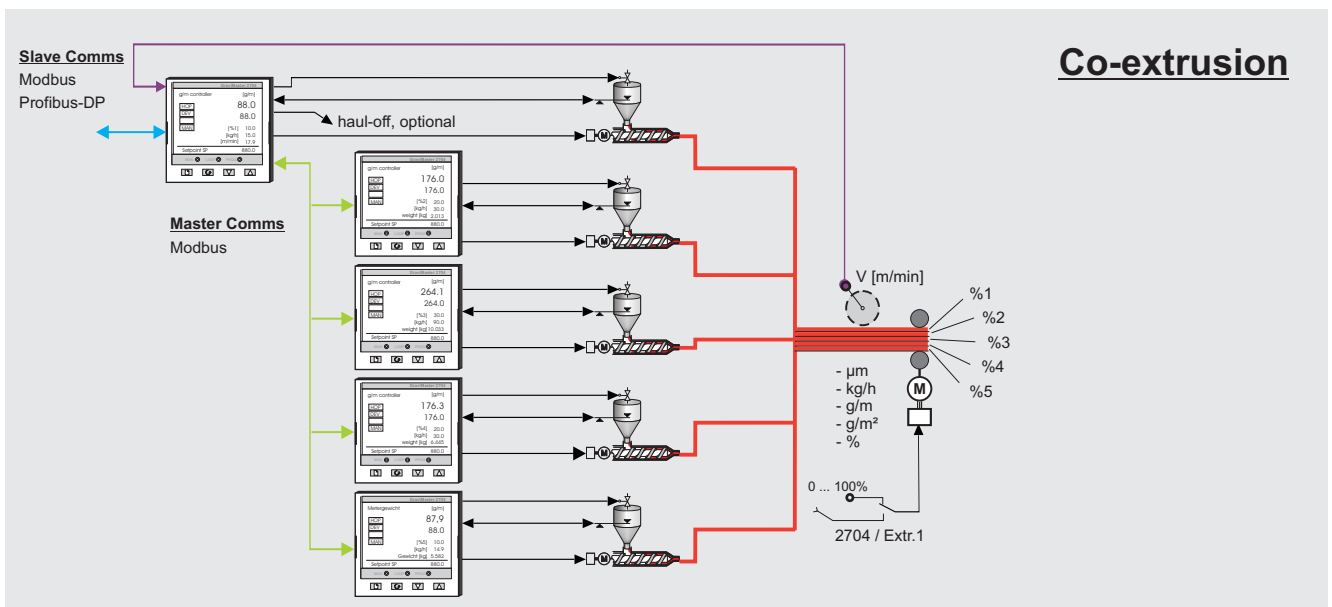

Co-extrusion

Co-extrusion

By means of communication channels and separate operation GraviMaster supports the division of tasks on an extrusion line. Individual extruders and feed components are connected together via the Gravimetric to form a system. One instrument takes over the coordination of set-points and exchange of operating states such as total set-point, percentage, enable, alarms or main set-point. The exchange of internal system information is carried out via serial communications in a master-slave configuration. From a supervisory computer, not only the master but also the slaves can be interrogated.

System Features
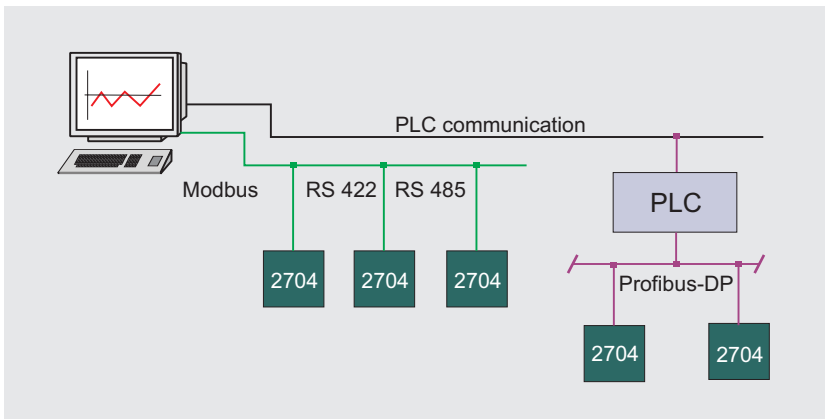
Interface Host

- PLC-Fieldbus
    (Profibus-DP, DeviceNet)

- PC-Interface (Modbus RTU)

All Gravimaster instrument parameters for operating or for configuration can be addressed. A complete exchange of all process values is possible. The protocols are internationally standardized.
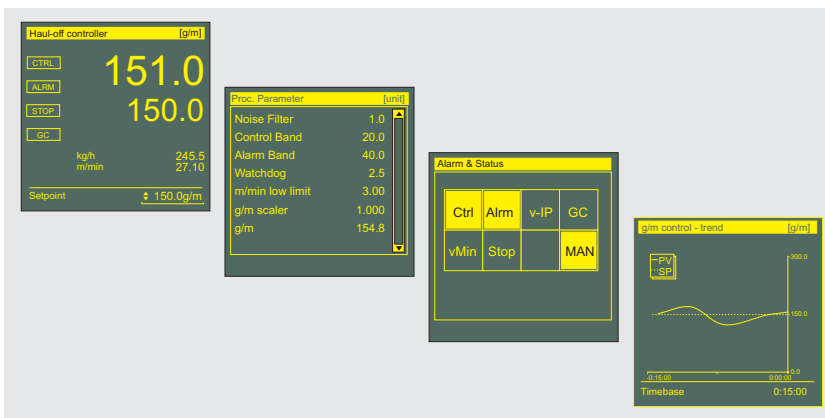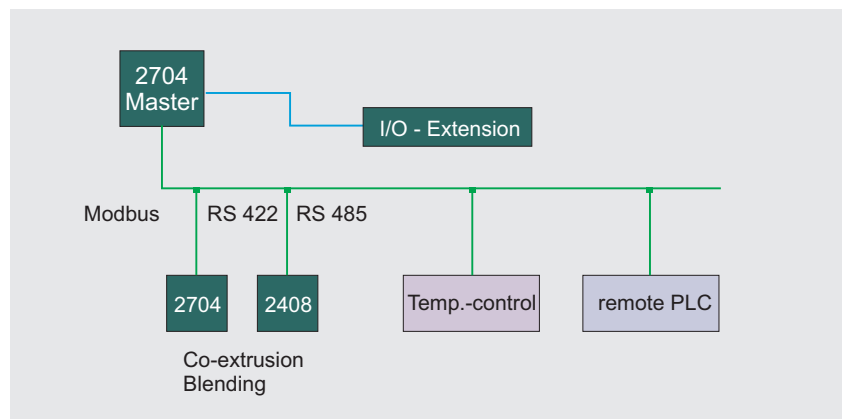
Configurations-Software : **iTools**

2704 control system

As a control system GraviMaster has an effect on lower level functions such as:

- temperature control

- pressure measurement

- drive

- internal / remote PLC

For entry and display of the subordinate instruments appropriate menus are available.

Operation

The bright matrix display has a resolution of 160x120 points and is prepared for the display of:

- control loops

- parameter lists

- trends

- diagnostic fields

- customer text in ASCII character
  sets

Language change-over: Engl., D, Fr.
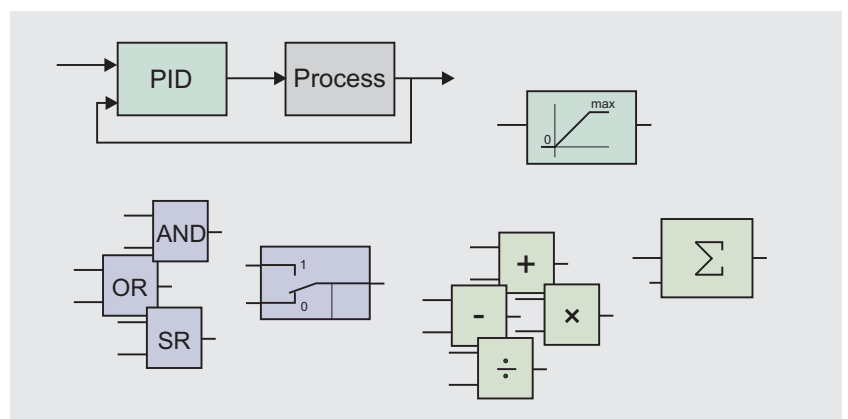

Internal Functions

As a supplement to Gravimetric for adaptation to process conditions numerous other functions are available that can be read in or output via hardware modules or interface communication.
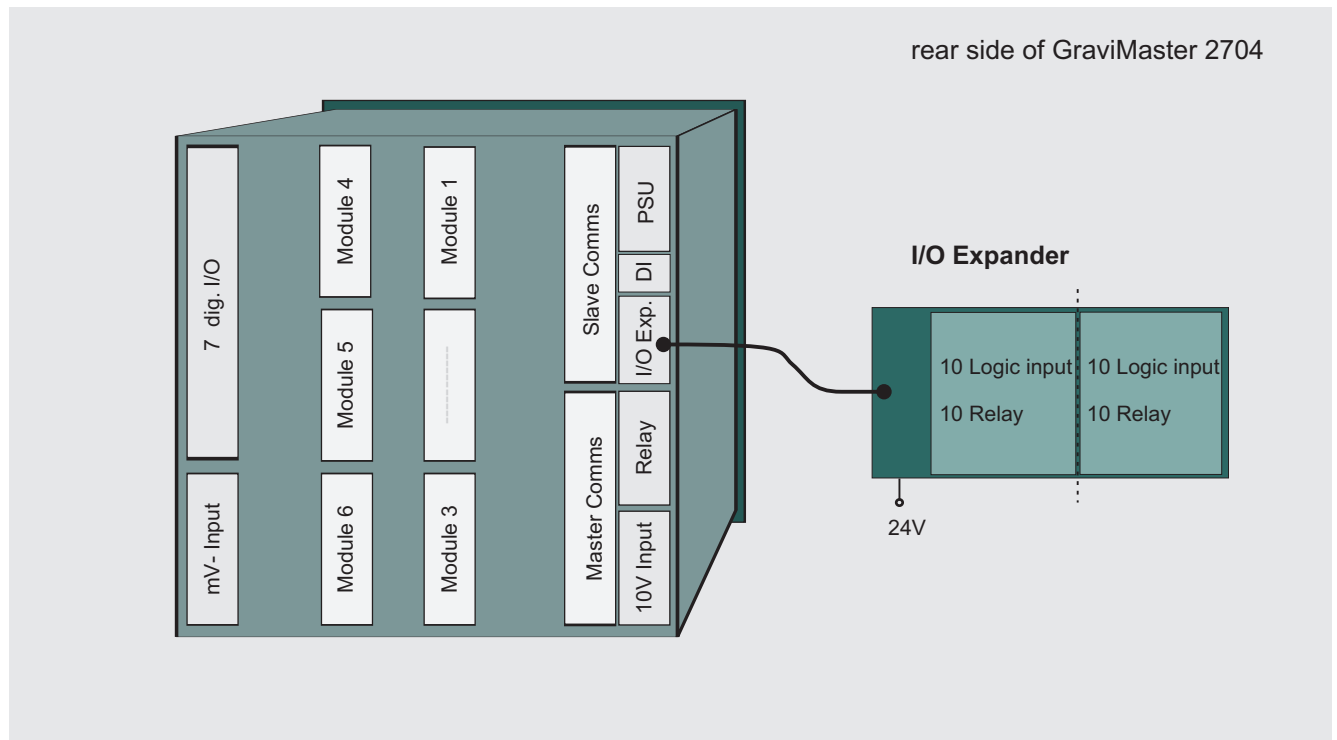
Analogue: control loops, ramps, calculator operations, totalizers, analogue switches, ...

Digital: logic, timers, switches,...

System: alarms, diagnostics, ...

Hardware options and expansions

rear side of GraviMaster 2704

I/O Expander

10 Logic input	10 Logic input
10 Relay	10 Relay

24V

7 dig. I/O · Module 4 · Module 1 · Module 5 · Module 6 · Module 3 · Slave Comms · Master Comms · PSU · DI · I/O Exp. · Relay · 10V Input · mV- Input

Instrument

Dimensions	96x96x150mm (WxHxD)
Installation	panel mounting with clips
Panel cut-out	92x92mm DIN
Power supply VH	85 ... 264 VAC, 50/60Hz
Power supply VL	20 ... 29 VAC/DC
Power consumption	max. 20W
Ambient conditions	<50°C operating temp., IP 54
	-10...70°C storage temp, 5...95% RH

I/O Expander

10 I/O expander	10 logic in, relays: 4 CO, 6 NO
20 I/O expander	20 logic In, relays: 4 CO, 16 NO
Supply	24VDC external

Modules

Load cell supply	10V, 300R
Single/ Dual relay	max. 264V, 2A; min. 12V, 100mA
Changeover relay	max. 264V, 2A; min. 12V, 100mA
DC out	10VDC, 20mA, 14bit, isolated
2x DC out	2x 4-20mA, 12bit, isolated, (1,4,5)
PV input	10VDC,17bit, isolated, (3,6)
Dual PV input	as PV, isol., comm.GND, 4.5Hz (3,6)
DC-input	10V/100mV, 14 bit, R_{in}= 10M (1,3,4,6)
Triple logic input	active: -3...5V ; inactive: 11 ... 30V
Triple logic output.	18V, 8mA each

Standard I/O

Load cell input	0 ... 40mV, isolated
Resolution	0.5 µV
Sampling	110ms
Logic I/O	7 I/O configurable and 1 Input
Isolation	not isolated
DI wiring	contacts, switches, relays
	level: -1... 2V =: ON (1)
	4... 35V =: OFF (0)
DO wiring	relay or LED via open collector
	remote supply : 24V (10 ... 35V)
	current per output: max. 40mA
Relay	changeover contact
	264VAC, 2A ... 1V, 1mA
10V Input	+/- 10V input, 14bit, R_{in} = >230k
	not isolated

Communications

Slave Comms	**to host**
Hardware	RS 232, RS 422, RS 485,
	Profibus-DP 1.5 Mbaud, DeviceNet
Protocol	Modbus RTU
	Profibus-DP, DeviceNet
Master Comms	**to peripherals**
Hardware	RS 232, RS 422, RS 485,
Protocol	Modbus RTU

Gravimetric mechanical units

Weigh hoppers	see product information KTW ...
Screw feeders	see product information CF ...
Blending units	see product information GCF ...

Software development tools

ProfiConf	GSD file configurator to set up GSD file from instrument parameters (Profibus-DP)
iTools/GM2704	configuration and instrument management tool including GM 2704-IDM-file
GraviSim	ectronicl simulation of weigh hopper and feeder or extruder
Step7-FB/connect	Simatic Step7 FB to handle GM 2704 via Profibus-DP. polling parameters
Step7-FB/demand	Simatic Step7 FB to handle GM 2704 via Profibus-DP polling & on-demand parameters

Auxiliary equipment

10 I/O Expander	additional 10 inputs and 10 outputs 4 changeover relays, 6 relays NO, 10 logic inputs, supply: 24V
20 I/O Expander	additional 20 inputs and 20 outputs 4 changeover relays, 16 relays NO, 20 logic inputs, supply: 24V
LCS	Load cell supply formax. 4 load cells in parallel, 6-wire, max. length: < 200m,
FVC	f/V‑converter to measure line speed from encoder, frequency: 0.1 Hz … 25kHz
ISC	Comms converter RS 232 to RS 422 or RS 232 to RS 485
Enclosures and cabinets	on request

Order code for hardware and application software:

GraviMaster / Instr / Appl / PSU / Mod.1 /-/ Mod.3 / Mod.4 / Mod.5 / Mod.6 / SlaveC / MasterC / Doc / Version

Instrument	2704	Dimensions, 96x96x150mm, Front IP54, 0 ...50°C, load cell IP [40mV, isolated, resolution: 0.5µV] 1 changeover relay, 7 I/O, 1 DI, 1 AI. [+/- 10V, 14bit, R_i >230k, not isolated]
	2704f	2704 Profibus-DP Hardware, else see 2704
Application	XXX	no application
	Appl. 1xx	extrusion system control
	Appl. 2xx	extruder throughput control
	Appl. 4xx	blend control/ extruder throughput control with feed-forward
	Appl. 6xx	kg/m control
Power Supply	VH	voltage range, world-wide, 85...264VAC, 48...62Hz, <20W
	VL	voltage range, 24VDC/AC, -15%, +20%

If an application is available the following hardware coding is not necessary

Modules 1...6	XX	no module					
1,3,4,5,6	R2	single relay, NO	1x	I_{max}: 2A	V_{max}: 264V$_{AC}$	V_{mni}: 12V$_{DC}$	I_{mni}: 100mA, R-load
1,3,4,5,6	R4	changeover relay	1x	I_{max}: 2A	V_{max}: 264V$_{AC}$	V_{mni}: 12V$_{DC}$	I_{mni}: 10mA, R-load
1,3,4,5,6	RR	single relay, NO	2x	I_{max}: 2A	V_{max}: 264V$_{AC}$	V_{mni}: 12V$_{DC}$	I_{mni}: 100mA, R-load
1,3,4,5,6	D4	DC control output	1x	isolated	V: 0...10V, R_L > 500R	I: 0...20mA,	R_L < 600R
1,3,4,5,6	D6	DC retransmission	1x	isolated	V: 0...10V, R_L > 500R	I: 0...20mA,	R_L < 600R
1,4,5	DO	dual DC output	2x	I: 4-20mA	12 bit		
1,4,5	HR	high resolution DC OP	1x	I: 4-20mA	15 bit	V: 24V/20mA	
1,3,4,5,6	TK	triple contact input	3x	isolated	On: <100R	Off: >28k	
1,3,4,5,6	TL	triple logic input	3x	isolated	V: 11...30V$_{DC}$	On: <5V	Off: >10,8 V
1,3,4,5,6	TP	triple logic output	3x	isolated	V: 18V$_{DC}$,	I_{max}: 8mA/channel	
1,3,4,5,6	LO	logic output	1x	isolated	V: 18V$_{DC}$,	I_{max}: 24mA	
3,6	PV	PV-Input, 16bit	1x	isolated	V: 0...10V$_{DC}$ ... U: +/- 40mV$_{DC}$	R_i >100M	
3,6	DP	dual PV-Input 16bit	2x	isolated	analogue Com	as PV	T_s=4.5 Hz
1,3,4,6	AM	DC- input, 14bit	1x	isolated	V: 0...10V$_{DC}$ ... U: 0...100mV$_{DC}$	R_i >10M	
1,3,4,5,6	G5	single load cell supply	1x	isolated	V: 10V$_{DC}$	R_L > 300R	
1,3,4,5,6	MS	transmitter PSU	1x	isolated	V: 24V$_{DC}$,	I_{max}: 20 mA	

Slave Comms/	XX	no serial communication	
Master Comms	A2	RS232	isolated
	F2	RS422	isolated
	Y2	RS485	isolated
as Slave	PB	Profibus-DP	isolated
on request	DN	DeviceNet	
Documentation	XX	no manual	
	D	German manual	
	E	English manual	
Version	> A 6.2	firmware	