GraviMaster 2704
Gravimetric Control for Extrusion and 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

Throughput
kg/m control
Co-extrusion
Blending

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**

**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**

**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

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.

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**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, ...

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**Diagram Description**
- **System Features Diagram**
  - PLC communication
  - Modbus
  - RS 422
  - RS 485
  - PLC
  - 2704
  - 2704

- **Interface Host Diagram**
  - PLC-Fieldbus (Profibus-DP, DeviceNet)
  - PC-Interface (Modbus RTU)

- **2704 control system Diagram**
  - 2704 Master
  - I/O - Extension
  - Modbus
  - RS 422
  - RS 485
  - 2704
  - Co-extrusion
  - Blending
  - Temp.-control
  - remote PLC

- **Operation Diagram**
  - Bright matrix display
  - Control loops
  - Parameter lists
  - Trends
  - Diagnostic fields
  - Customer text

- **Internal Functions Diagram**
  - PID
  - Process
  - Analog
  - Digital
  - System
Hardware options and expansions

**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, Ri = 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 isol: 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, Rn = >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 electronic 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

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>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

<table>
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<th>Modules 1...6</th>
<th>XX</th>
<th>no module</th>
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<tbody>
<tr>
<td>1,3,4,5,6 R2</td>
<td>1x</td>
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<tr>
<td>1,3,4,5,6 R4</td>
<td>1x</td>
<td>changeover relay</td>
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<tr>
<td>1,3,4,5,6 RR</td>
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<td>DC control output</td>
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<tr>
<td>1,3,4,5,6 D6</td>
<td>1x</td>
<td>DC retransmission</td>
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<tr>
<td>1,4,5 DO</td>
<td>2x</td>
<td>dual DC output</td>
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<tr>
<td>1,4 HR</td>
<td>1x</td>
<td>high resolution DC OP</td>
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<tr>
<td>1,3,4,5,6 TK</td>
<td>3x</td>
<td>triple contact input</td>
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<tr>
<td>1,3,4,5,6 TL</td>
<td>3x</td>
<td>triple logic input</td>
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<tr>
<td>1,3,4,5,6 TP</td>
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<td>1,3,4,5,6 LO</td>
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<td>logic output</td>
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<td>3,6 PV</td>
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<td>PV-Input, 16bit</td>
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<tr>
<td>3,6 DP</td>
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<td>dual PV-Input 16bit</td>
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<tr>
<td>1,3,4,6 AM</td>
<td>1x</td>
<td>DC- input, 14bit</td>
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<td>1,3,4,5,6 GS</td>
<td>1x</td>
<td>single load cell supply</td>
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<tr>
<td>1,3,4,5,6 MS</td>
<td>1x</td>
<td>transmitter PSU</td>
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<td>Slave Comms/ Master Comms</td>
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<td>A2</td>
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<tr>
<td>on request</td>
<td>DN</td>
<td>DeviceNet</td>
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Documentation
XX | no manual |
D | German manual |
E | English manual |

Version > A 6.2 firmware