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Technical data subject to change.

We have checked the contents of this manual for agreement with the hardware and software described. Since deviation cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.
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Preface

Dear User

In choosing VISCOTHERM equipment you have chosen an advanced system that is both tried and tested.

Our continued efforts at product improvement aim first and foremost to give complete customer satisfaction. Should any problems arise with your equipment, please do not hesitate to contact our service department who have all the expertise to give you the right advice.

This manual contains all the instructions that you will need for operating and maintaining the system, and for ordering spare parts.

Before carrying out any alterations that are likely to affect the handling and the behavior of the equipment, please contact our service department who will also supply you with all relevant additional information.

Only VISCOTHERM original spares have the required quality and compatibility.

Our warranty is subject to all maintenance work being correctly and carefully carried out.

Repair work must be undertaken by specially trained staff only.

We are confident that your VISCOTHERM equipment will give you long and trouble-free service.

VISCOTHERM AG

Notices relating to this equipment are described under three headings:

**WARNING**  Failure to observe instructions under this heading is liable to cause serious accidents leading to personal injury and even death.

**CAUTION**  Failure to observe instructions under this heading is liable to damage or destroy the equipment.

**NOTE**  Instructions under this heading draw your attention to specific features of the equipment.

Please also take note of any instructions appearing on the equipment, or supplied with it.
Safety notices

Please read the following safety instructions CAREFULLY.

Make sure that all staff using the equipment are fully informed of its operating requirements. Keep this manual in a safe place.

Also make sure that all local and national safety standards are met.

Prior to any maintenance or repair work, ensure that:

- the hydraulic pump unit is not running
- the power leads to the electric motor are disconnected (withdrawal of fuses)
- the power supply to the control circuit via the hydraulic pump unit is cut off (withdrawal of fuses)

Prior to operating the equipment for the first time, ensure that:

- the equipment is correctly installed and wired up.
- hydraulic and cooler lines are correctly connected and sealed.
- the monitoring instruments operate correctly.

When maintaining or operating the equipment, watch out for:

- any unusual noises, vibrations or heat points.

After stopping the equipment, ensure that:

- the main switch is on Off and locked in that position.
1. Unit

1.1. Configuration

The adjusted configuration of this unit:

Device type:
Serial number:
Voltage: \( V \) AC
Bowl drive:
ProfiBus-bus number:
Rotodiff:
Swapt volume: \( l/\)rotation
Pump unit:
Maximum pressure: \( \text{bar} \)
Power of elec. motor: \( kW \)
Flow: \( l/min \)
Oil temperature meas.: \( ^\circ C \)

Adjusted:
Date: Name:

The parameters of CVC 600 have been preset to fit the equipment in compliance with the basic values of the Rotodiff and the pump unit. On modifying the construction, the respective parameters of CVC 600 have to be readjusted anew by specially instructed skilled personnel.
1.2. Type plate – arrangement and identification
1.3. Short description

This electronic display and control system is used for continuous regulation of hydraulic VISCOTHERM ROTODIFF Systems for decanting centrifuges. The CVC system operates by means of an efficient microprocessor ensuring absolutely precise measuring and control (digital signal processing). All key operating parameters can directly be set at the equipment. All regulating targets, measuring values, operating status and disturbance messages are transmitted via the integrated Profibus DP interface to the control station. By means of the universal, software-supported end-stages of valves many different pump types (including also position adjustment) can directly be controlled without any hardware modification. Strict use of pluggable connecting terminals.

Visualizing of:
- Bowl speed in rpm
- Differential and scroll speed in rpm
- Hydraulic pressure (torque) in bar
- Additional measurement values (e.g. oil temperature, vibration, ...)
- Operating hours of Rotodiff, maintenance interval indicator

Plaintext display of:
- Cut-off pressure p2 in bar feeding pump off
- Cut-off pressure p3 in bar bowl drive off
- Standstill of centrifuge
- Disturbance messages

Selectable languages: German, English, French, Portuguese, Spanish, Dutch, Norwegian, Italian

Process control:
- Change-over to 9 different curves ensuring process control
For every regulating curve, the following values may be set:
- Base speed
- Control pressure p1
- Regulating stiffness α (only linear regulating curves)
- Cut-off pressure p2 (feeding pump off)
- Cut-off pressure p3 (bowl drive off)
- Pressure limitation (only by visualizing)
- Speed limitation (only by visualizing)
- Curve characteristics and form (only by visualizing)

Speed regulation:
- Adjustment to the set nominal value, thus correcting automatically any deviations from rpm values due to ageing.

Remote adjustment:
- All regulating parameters can be remote-adjusted via profibus DP.
- Change-over commutation of all regulating curves by means of relay points. Optional visualizing for modifying adjustment of regulating parameters.
2. System overview

2.1. Control system

A CVC600 Control- and display unit
B PLC / SPS Cellcontroller
C Control cabinet
D External visualizing
**Communication CVC600 – PLC**

Using the profibus, the measured values referring to system pressure, bowl speed, scroll speed and differential speed as well as power are transferred from CVC600 to 5 free analog measuring channels. Likewise, the currently set regulation (regulating curve, base speed, control pressure, regulating stiffness/slope, pressure switch values) are transmitted to cell control. Via cell control, new adjustments for the regulating process can be performed. In connection with full hydraulic, the nomal target value for the bowl speed can also be preset.

**Communication CVC600 – control cabinet**

CVC600 transmits the measured values referring to system pressure, power, bowl and differential speed by way of 4 – 20 mA current signals.

The relay outputs of the pressure switches of CVC600 are used for shutting down product feed (p2) and switching off the bowl drive (p3).

The relay curve to be activated can be selected by means of relay points in the control cabinet.

**Communication CVC600 – external visualizing**

In most cases, external visualizing is used to put the system into operation as well as in order to carry out the first adjustment of the CVC600 control unit. Visualizing allows to view the regulating curves graphically and to adjust them according to the operator’s own requirements. Visualizing is connected to the serial interface (RS232) of CVC600.
2.2. Scroll drive

A  CVC600 Control- and display unit
E  Pump unit
F  ROTODIFF
2.3. Scroll- and bowl drive, compatible full hydraulic

A  CVC600 Control- and display unit
F  ROTODIFF
G  Pump unit (full hydraulic)
H  Power measurement
2.4. Scroll- and bowl drive, external amplifier

A  CVC600 Control- and display unit
E  Pump unit
F  ROTODIFF
I  External amplifier (variable frequency drive)
J  Bowl drive motor
3. Operating/control and display

On activating the control key, the currently set value appears on the second line of the display. The arrow keys are used for modifying and adjusting the selected value. If the latter is to be taken over by the system, the Enter key has to be pressed. Should the modifications/adjustments have to be disregarded, you should press the Esc key for discontinuing the operation – and then the standard display is again shown by the screen. Unless an input takes place within 10 seconds, CVC 600 also reverts again to the standard mode and control operations are discontinued.

3.1. System help

Using the help key, it is possible to interrogate any operating key on the front panel in respect of its function. You should first press the help key and then the operating key whose function is not known to you. The integrated help system depends on the current status of the machine. In case of a faulty status, a help text is displayed which explains how to eliminate the fault or error.

3.2. Change-over of regulating curves

Use this key in order to select the desired regulating curve between 1-9, and then the curve actually set is shown on the red segment display.

After pressing this key, the second line of the CVC display shows the current regulating curve. Afterwards, the respective values can be modified/adjusted by using the arrow keys. Should the displayed value actually be taken over by the system, then please press the Enter key. Now the red segment display changes over to the newly set regulating curve.

Every regulating curve comprises the following parameters:
3.3. **Base speed**

The parameter base speed is correlated with the regulating curve then activated. The base speed corresponds to the minimum rpm existing just before the system’s regulating process starts.

After pressing the key “base speed”, the respective value can be set by means of the arrow key.

If the value displayed should be taken over by the system, then please press the key Enter.

3.4. **Control pressure**

The parameter control pressure is correlated with the regulating curve then activated. Control pressure corresponds to the initial point of the regulating process; from this pressure onward the scroll’s speed is increased in dependence on the pressure.

After having pressed the key “control pressure”, the desired value can be set by means of the arrow keys.

If the value displayed should be taken over by the system, then please press the key Enter.

3.5. **Regulating stiffness, control slope**

The parameter regulating stiffness is correlated with the regulating curve then activated. The regulating stiffness determines the increase of the scroll’s speed in dependence of the pressure existing after the initial control pressure.

After having pressed the key “regulating stiffness”, the desired value can be set by means of the arrow keys.

If the value displayed should be taken over by the system, then please press the key Enter.
3.6. **Pressure switch p2, green flag**

The parameter pressure switch p2 is correlated with the regulating curve then activated. Whenever the existing pressure is higher than the pressure set, product feed is shut down.

After having pressed the key p2, the desired value can be set by means of the arrow keys.

If the value displayed should be taken over by the system, then please press the key Enter.

3.7. **Pressure switch p3, red flag**

The parameter pressure switch p3 is correlated with the regulating curve then activated. Whenever the existing pressure is higher than the pressure set, the bowl drive is shut down.

After having pressed the key p3, the desired value can be set by means of the arrow keys.

If the value displayed should be taken over by the system, then please press the key Enter.

3.8. **Operating hours**

This key is used for the display of Rotodiff’s operating hours, which are recorded once the hydraulic pressure is higher than 5 bar. In addition to Rotodiff’s operating hours, the hours remaining until the next change of oil and the next Rotodiff overhaul due are indicated. Setting back of the indicators oil change or Rotodiff overhaul will be described subsequently.

3.9. **Bowl speed (full hydraulic only)**

This key is only used if the system is based on full hydraulic.

After having pressed the key F1, the desired value can be set by means of the arrow keys.

If the value displayed should be taken over by the system, then please press the key Enter.
3.10. Functions of system help display

The functions of system help display are especially used in order to observe the signals at the centrifuge or in the communications area. Every time the system is restarted, return to the standard display always takes place. Internal and external measured values are shown on the two lowest placed lines. The following help display texts are available:

- Normal standard display
- Scroll speed
- Oil temperature
- Channel 1
- Channel 2
- Channel 3
- Channel 4
- Channel 5
- Diagnostics speed regulator
- Diagnostics Rotodiff
- Diagnostics bowl drive
- Profibus diagnostics

The help display texts are shown by pressing the key **F3**. Thereafter, please use the arrow keys **↑** and **↓** to select the desired function. By means of the key **Enter** the function is activated.

3.10.1. Normal standard display

The normal standard display is shown just after having started the system. Items shown are the bowl speed as measured and the differential speed obtained by calculation out of the bowl and the scroll speed.
3.10.2. Scroll speed

This help display function indicates the measured bowl speed as well as the measured scroll speed in the aim of eliminating faults connected with rpm speeds.

3.10.3. Oil temperature

This help display function shows on the lowest line the oil temperature as measured. Should the respective measured value not be available, then CHANNEL OFF is indicated.

3.10.4. Channel 1 to 5

This help display function shows on the lowest line the value referring to the channel involved. Should the respective measured value not be available, then CHANNEL OFF is indicated.
3.10.5. Diagnostics speed regulator

This help display function indicates on the lowest line the actual value referring to the speed regulator. The speed regulator is only set going after attainment of a minimal bowl speed of 500 rpm. The speed regulator corrects the differential speed value by a maximum of ±10% of the maximum differential speed, corresponding to ±100% of the speed regulator.

3.10.6. Diagnostics of Rotodiff

If the system is provided with a proportional valve, this help display function indicates on the third line the target value of the valve amplifier.

If the system is provided with a control pump, the target value is likewise shown on the third line, whereas the pump's actual value is shown on the fourth line.
3.10.7. Diagnostics bowl drive

If the system is provided with a proportional valve, this help display function indicates on the third line the target value of the valve amplifier. If the system is provided with a control pump, the target value is likewise shown on the third line, whereas the pump's actual value is shown on the fourth line.

If the system is provided with a control pump, the target value is likewise shown on the third line, whereas the pump's actual value is shown on the fourth line.

3.10.8. Profibus Diagnostics

This help display function indicates on the third line the internal status of Profibus DP Slaves. On the fourth line, the status of the automatic Baud rate search is indicated. It is only after the automatic Baud rate search has changed over to „DP_CONTROL xxxx“ (bus signals available, hardware probably ok) that the internal status machine is set going. Once „DATA EXCHANGE“ is indicated on the third line, this means that the data are exchanged with a master system.
3.11. Acknowledge oil change

Press the key with the clock symbol.

The key F2 now enables you to acknowledge the oil change.

With the key Enter you acknowledge the input, storing also the new counting level of the counter.

For checking, please press again the key with the clock symbol.

On the third line, the number of hours remaining prior to the new change of oil must again be positive.
3.12. Acknowledge overhaul Rotodiff

Please press the key with the clock symbol.

![Image showing the screen with operation and oil change hours]

The key F3 now enables you to acknowledge the overhaul.

![Image showing the options to acknowledge or terminate]

With the key Enter, you now acknowledge the input, storing also the new counting level of the counter.

For checking, please press again the key with the clock symbol.

![Image showing the screen with updated hours]

On the third line, the number of residual hours remaining prior to the new Rotodiff overhaul must again be positive.
4. Regulation characteristics

4.1. Torque and filling ratio

Only in case of incompressible\(^1\) solid matter or deposits / sediments does the filling ratio correspond to the torque relating to the scroll. The torque corresponds exactly to the quantity of solid matter deposited in the machine at the specific moment involved. In case of compressible\(^2\) solid matter or deposits / sediments, the torque provides only insufficient information about the filling ratio relating to solid matter. With compressible deposits, the scroll’s torque develops out of two components:

- Effect of the gliding friction undergone by the scroll while it is immersed in sediments subjected to high compression (external friction of sediments).
- Effect of the sediments' resistance against being displaced and/or transported by the spiral-related advance (internal friction of sediments).

While the first phenomenon entails a slippage resistance, which hardly depends on the scroll’s speed (similar to a disc brake), the resistance of the sediments against displacements increases parallel to the scroll’s speed. The respective prerequisite requires naturally that the filling ratio relating to solid matter in the machine remains unchanged. With the filling ratio remaining on an identical level, the torque increases along with increasing differential speed, and hence the following holds good:

In order to obtain a constant solid-matter filling ratio, the differential speed must be reset higher whenever the torque is increasing.

---

1 incompressible: Although the sediment still contains some liquid, its volume cannot be further reduced in any way whatsoever. Granular sediments are examples of this kind.
2 compressible sediments: Sediments which can be further compressed subject to the factors compression and time. Examples are: mud, silt, sewage sludge, harbour ooze and the like.
The more dense sediments are, the more they resist their being displaced. With increased differential speed, the sediment also develops an increasing resistance against increased conveyance / transport speed. The increase in resistance set in relation to the increase in differential speed results in the angle $\alpha$.

Because, as a rule, the external friction of the sediments increases also along with increasing compression, the following lines relating to sediment friction parameters are obtained for sediments with different degrees of compression:

![Diagram](image)

So as to be able to control a machine in such a way to keep its solid-matter filling ratio on a constant level, it is necessary that the regulating parameter line, or in other words the regulating sections proper, coincide with the parameter line relating to sediment friction.
4.2. Handling the regulation procedure

In order to handle and control a regulating procedure working according to the analog principle, it is sufficient to input 3 preset regulating values:

- $p_1$: pressure control threshold value
- $\Delta n_1$: base speed
- $\alpha$: regulating stiffness (increase of differential speed per pressure unit)

$p_1 = $ Pressure control threshold value

A reasonable compression process of sediments within the machine can only take place provided that a certain agglomeration and/or a certain height of precipitation / sedimentation has been reached. This means that the regulating process may only begin once the machine has accumulated, i.e. stored, enough solid matter. The less weighty the sludge's are, the lower the pressure control has to be set. Should the pressure control be set too high, the bulky sediment will displace more and more clarification space, this up to the extent when the product transits untreated through the machine. If the pressure control is set too low for a heavy sludge, the mass of solid matter gets too wet.

$\Delta n_1 = $ Base speed

The base differential speed ensures that the machine works at a minimum conveying speed of the scroll. If its value is set at too low a figure, the machine gets choked, such as when the building of the "bottom" is just in its initial stages or has been partially destroyed (for example during initial feeding of sewage etc. or when the feeding is interrupted). If the base speed is set too high, the regulation process will not work when the share of solid matter is too low, and the discharged material will also be correspondingly wet.

Attention: When the separation process is burdened, i.e. under stress, the base speed may not be reduced, as with reverse regulations the differential speed may drop down to a dangerously low level. This may entail the machine’s getting choked on receiving the next batch of solid matter.

$\alpha = $ Regulating stiffness

The regulating stiffness is a measuring unit for the consistency of the discharge of solid matter. If the $\alpha$ value is set too low, the regulating process tends toward instability. That’s because the increase in torque set in relation to the increase in differential speed is higher than the increase in torque required by the regulating curve in respect of the same increase in differential speed. The differential speed rises incessantly until the machine has been largely emptied, after which the differential speed diminishes again. Once the differential speed has dropped again to the base speed, the machine gets again filled until regulation resumes, whereupon it again gets emptied. If the $\alpha$ value is set too high, the machine gets again filled with an increasing load of solid matter to such an extent, that the clarification process gets impaired and / or obstructed. The $\alpha$ value must be set in such a way as to keep the regulating process on a barely stable level (see figure).

---

3 (= solid matter between the crest [comb] of the scroll and and the bowl’s inside wall)
4.3. Designing regulating processes with supporting point

The regulating curves 1 up to 7 of this display and control unit make possible nonlinear regulating processes, whereby the machine can be matched in an optimal manner to the required operating conditions.

4.3.1. Principle of nonlinear processes

As a rule, the regulating stiffness (increase of differential speed per pressure unit) should predominantly correspond to the friction behavior of the sediment (in rheological terms, the internal friction resembles the characteristics of viscosity), while (when subject to constant feeding of solid matter) it should, with increasing differential speed, produce a linear torque increase parallel to the differential speed. However, if rheological conditions of the conveying conditions of solid matter change while the differential speed is increasing, the regulating curve must show a nonlinear pattern.

For example, a concave pattern has to be selected for the curve in respect of sediments mixing ("miring") too much with less compressed strata in case of too high a conveying / transport velocity rate and / or too high a differential speed, such as happens with coal. The concave pattern thus prevents an excessive increase of differential speed along with increasing load while keeping the sediments largely compact over the transportation distance.

It is advisable to select a convex regulating curve in case of sediments which are only with great difficulty able to form a resistant bed on the bowl. Such sediments strongly tend to flow back and forth between the bowl and the scroll's spiral, thus accumulating a back-pressure of solid matter. If the differential speed increases along with an increasing load of solid matter, this ensures a fast renewal of the sediment bed while limiting the load of solid matter fed into the machine.
4.4. Curves 1-4

Depending on the change in consistency of the discharged matter, specific product-related curves have to be designed when starting operations. These curves may later be implemented without any further adjustment.

The switching off of the bowl’s rotational speed $p_3$ is set at 260 bar. The switching off of the product feed is set depending on the regulating curve.

<table>
<thead>
<tr>
<th>Curve-nr.</th>
<th>$p_2$ [bar]</th>
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<tbody>
<tr>
<td>1</td>
<td>180</td>
</tr>
<tr>
<td>2</td>
<td>220</td>
</tr>
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<td>3</td>
<td>240</td>
</tr>
<tr>
<td>4</td>
<td>240</td>
</tr>
</tbody>
</table>
4.5. **Curve 5 (concave regulation section)**

**Application:** Sediments with low cohesiveness (low cohesive force)

This regulating mode is predominantly used with sediments of low cohesive force\(^4\) (low cohesiveness), which thus get - along with increased conveyance/transport speed (differential speed) - more flowable („miring“), such as coal heaps. Once this phenomenon does occur, the moving of the sediment gets more difficult until finally almost no material is discharged. Consequently, the filling ratio increases incessantly while the torque increases only slowly until the clarification process is seriously impaired or the product feeding is switched off. In such a situation, the machine may possibly dwell for considerable time at this operating point. A linear regulating mode consequently runs the risk of shifting its stable operating point towards the curve’s extreme right-hand side, far removed from the operating point favoring the separating process. Because these sediments mostly correspond to a relatively small differential in torque depending on the solid-matter filling ratio, the regulating curve must show a rather flat pattern at the operating point (high increase in differential speed with respect to the torque unit). When the torque is in the process of increasing, the differential speed should always augment so as not to increase the sediment’s flowability. Therefore, the regulating characteristics should correspond to a concave curvature toward the right-hand side. Thereby, the stable operating point of the regulating process is again shifted leftward, i.e. near the best operating point in respect of the process technology involved.

4 Cohesion: the cohesiveness of a specific matter’s molecules. It is based on the attractive power (cohesive forces) occurring between particles. Due to the existence of cohesion, it is necessary to exercise a certain force in order to be able to break, crush or deform a physical body or substance.
4.6. **Curve 6 - 7 (convex regulation section)**

**Application:** fragile bed

This regulating mode is predominantly used with sediments generating a fragile bed\(^5\) (bottom). In these instances, the very nature of the solid matter does not allow the formation of a continuous and coherent sedimentary layer of a comparatively permanent duration. Instead, the layer has to be partially or entirely renewed at every spiral rotation. This may be attributable to bad adhesives\(^6\) or to an insufficient compression and compacting capability of the sedimentary layer. However, it is also possible that light but rather bulky or unwieldy parts of solid matter may rip apart the sedimentary layer (e.g. sewage sludge: drainage of floating cover [surface scum] of the thickener).

A deficient formation of this „bed“ layer and its recurrent destruction tends to favor, in the machine’s conical part, a flowing back of the sediment between the scroll’s crest and the bowl’s inside wall. This flowing back may reach a dimension that the machine no longer discharges any solid matter at all and that the solid-matter filling ratio is steadily increasing thereby.

A swift increase of the differential speed will improve the formation and the renewal of the „sedimentary bed“, improving also the conveyance / transport of the solid matter and thus relieving, i.e. reducing, the filling ratio. However, should the differential speed rise too hesitantly while the torque is increasing, then the solid-matter congestion will increasingly spread into the cylindrical part. Although a fairly suitable formation of the sedimentary bed will take place subsequently, the sediment thus accumulated shows such a high compacting degree that the machine gets switched off because the scroll’s a torque is far too high.

However, by selecting a linear regulating mode whose slope roughly corresponds to the consistency of the solid matter, one runs the risk of regulating the differential speed at too low a level, thus possibly switching off the machine as a consequence of the scroll’s increasing torque. In case of such a regulating mode, the stable operating point remains on the curve’s left side; and when leaving this position, the operating point invariably moves towards the switch-off point of the machine. Only by means of a steadily increasing differential speed along with an increasing torque is it possible to still empty the machine in good time. This corresponds to a convex curvature of the regulating curve.

**Note:** The commencement of every feeding process at a decanter shows a similar behavior because in this instance, too, it is first of all necessary to form the „bed“ or bottom layer! If in such a case there is merely a linear regulating mode, one again faces the risk of switching off the machine because the scroll’s torque is too high. One tries to avoid such an occurrence by increasing the quantity fed into the machine only very slowly during a rather long time-span.

---

\(^5\) Layer of solid matter between the scroll’s crest (comb) and the inside wall of the bowl.

\(^6\) Adhesiveness: the reciprocal adhesion between two substances, the cause being the attractive power between particles.
4.7. Curve 8 (analog operation)

4.7.1. Regulation characteristics of analog controls

The regulation curve 8 of the display and control unit permits a regulation which, when a variable solids loading occurs in the machine, allows an optimum separation.

Analog regulation objective

The solids loading of the machine, or degree of solids „filling“, is decisive for the separation results. If this „filling“ level can be kept constant when the solids loading changes (by a regulated differential speed variation), then the optimal separation results can be obtained.

Layout of Analog regulation curve

The control of a machine with a constant solids filling level demands that the regulation curve should correspond to the sedimented solids frictional characteristics.

**Differential speed range:**

\[ \Delta n_1 \] Base speed  
\[ \Delta n_a \] Working speed  
\[ \Delta n_e \] Emergency speed  
\[ \Delta n_{max} \] Maximum differential speed

**Pressure stages:**

\[ p_1 \] Regulation pressure threshold  
Pressure at which the differential speed is increased - Start of regulation  
\[ p_2 \] Cut-off product feed pump  
Pressure at which the feed pump is cut-off  
\[ p_3 \] Cut-off bowl drive  
Pressure at which bowl drive on centrifuges is cut-off  
\[ p_{max} \] Maximum system pressure  
If this pressure is reached, the scroll speed is reduced  
\[ \alpha \] Regulation slope  
Rate of scroll speed increase with pressure increase
4.7.2. Adjustment at starting-up of the analog controls

**Caution:** Before the machine is started, the initial data for the regulation must be chosen and adjusted.

**Start-up checklist:**
- All signal control wiring connected
- Main switch „ON“
- Check that the display-control unit is powered before the pump unit runs
- Display values checked before regulation parameters changed
  (consult 1.3.10 practical advice)

**Experience:**
- Regulation pressure \( p_1 \) ca. 40 - 60 bar
  (at high pressure hydraulic unit ca. 80 - 100 bar)
- Base speed \( \Delta n \) ca. 4 rpm
  (the larger the ROTODIFF, the smaller the diff. speed)
- Regulation slope \( \alpha \) ca. 10 bar rpm

**Shut-down machine:**

**Caution:**
1. Bowl must be stationary
2. Pump unit electric motor „OFF“
3. Power supply CVC „OFF“

**Note:** These initial setting should, from experience, suffice for the start-up phase. Observation of the separation results and fine-tuning must follow.
4.8. Curve 9 (digital operation)

4.8.1. Principles of digital operation

There are many cases, where analog regulation is unsuitable, for instance:

- During test works, where the machine is operating under precise feed conditions or parameters.
- During operations where the torque is handily measurable, or where the level of filling of the machine produces no torque, as for instance:
  - with very light suspensions (thickening).
  - with light suspensions, where occasionally heavy particles occur, producing a rapid torque rise.
- During operations where the torque is irrelevant, or of little importance to the regulation, as for instance in classification.

In all of the above cases, the differential speed is manually adjusted. To avoid the danger of plugging (caused by a sudden heavy sedimentation or by a slow accumulation of heavy particles) it is necessary, in emergencies, for a rapid increase in differential speed to purge the machine. Thus, the maximum adjusted differential speed should allow for a reserve of differential speed to free the machine in emergencies. For small machines this should be 25 - 30 % and for larger machines 15 - 20 % of the adjusted speed.

In conclusion, it can be said that in the above cases, the torque is not a regulation function, but is used only in emergency situations.
4.8.2. Adjustment at starting-up of the digital regulation

**Caution:** Before switching to the digital mode, select a high differential speed, to ensure that the decanter will not plug.

**Start-up checklist:**
- All signal control wiring connected
- Main switch „ON“
- Check that the display-control unit is powered before the pump unit runs
- Display values checked before regulation parameters changed (consult 1.3.10 practical advice)

**Experience:**
- Base speed $\Delta n$ ca. 5 - 90 % from the max. differential speed
- Regulation pressure $p_1$ (boost pressure) ca. 100 bar
- Regulation slope $\alpha$ (dampening) ca. 2 bar rpm

**Shut-down machine:**

**Caution:** The ROTODIFF drive must be stopped, and the bowl stationary before the power to the shut-down of the pump unit.

**Note:** These initial setting should, from experience, suffice for the start-up phase. Observation of the separation results and fine-tuning must follow.

4.9. Emergency functions

**Note:** All emergency functions work directly on the external controls.

- Shut-down point for the feed ($p_2$) is set with the potentiometer (M).
- Shut-down point for the bowl drive ($p_3$) is set with the potentiometer (K).
- Level of the hydraulic oil in the tank is controlled by the level / temperature switch.
- Temperature of the hydraulic oil in the tank is controlled by the level / temperature switch.

These functions are also described in the operating instructions of the respective pump units.
4.10. Practical advice

Setting operations should commence when the oil has reached working temperature 40-45°C. The testing and calibrating is of this temperature of the control system.

Rule 1
- When in doubt select a high base speed setting.
- If the base speed is too low blockage may occur, especially if the solids feed loading rapidly increase.
- If the base speed is too high the scroll cannot generate enough torque for regulation.

Attention: Never turn back the base speed to zero, when the system is regulating, since when the machine returns from regulation to base speed, blockage will occur.

Rule 2
- A low regulation threshold setting is preferable.
- At a low regulation threshold setting the solids output is too wet (due to insufficient solids loading of the centrifuge).
- If the regulation threshold setting is too high, the machine is overloaded with solids. Consequences: danger of blockage.
- Quality of recovery deteriorates, since the working range is too close to the emergency condition.
- Light suspensions, i.e. light voluminous solids, which produce no high scroll torque, require that the regulation threshold should lie under the pressure at which, normally, the machine is at the limit of solid loading. Should this limit be exceeded, the machine „tips“, i.e. no solids output, the product simply flows, without sedimentation, through the machine.

Rule 3
- The regulation stiffness should be set so that, the regulation is just stable. The less the stiffness, the more the tendency to over-react, that means: the more brutal the reaction of the regulation the more the level of filling of the machine is reduced.
- Since the filling rate of the machine depends on the indeed solids, the working conditions can thus oscillate.

The diagram opposite, shows how an increase of regulation stiffness stabilizes the working conditions. The heavy line portrays the rate of solids input in the machine. This oscillation can be observed on the flow meter and also on the manometer pressure switch. Should the regulation stiffness, far exceed the stable value, the level of filling is increasing when the feed input increases. The same effect occurs when the regulation threshold is too high. Baseally, a high regulation stiffness is required with a heavy and easily transportable solid in the machine and vice versa. Feststoff.
Note: Products which cause „chatter“ (polysaccharides, sulfur, coagulated blood etc.) will not react to changes in the regulation stiffness.

„Chatter“ vibrations can be reduced by changing the impedance of the hydraulics system: a VISCOTHERM expert will advise.

Finally, two important rules of behavior:

Rule of patience: The machine needs a certain time to adapt to the changing of the regulation parameters. This adaptation time-lag increases with the size of the machine.

Rule of simplicity: A small number of control possibilities leads to a simple and safe system. Normally the operating-crew should only adjust the regulation threshold, based on the following results:

- Should the cake be too wet: increase the regulation threshold
- Insufficient recovery: reduce the regulation threshold
5. **Control**

5.1. **Remote control with relay**

Remote control with relay takes precedence over any other type of change-over commutation of curves.

**External preselection of regulating curve 9 (digital)**

By means of an external relay point (terminals 81 and 82), change-over to the digital regulating curve (9) can be achieved. As long as the relay remains activated, the system runs on the said regulating curve.

**External preselection of regulating curve 8 (analog)**

By means of an external relay point (terminals 83 and 84), change-over to the analog regulating curve (8) can be achieved. As long as the relay remains activated, the system runs on the said regulating curve.

**External preselection of regulating curves 1 bis 7**

By means of three external relay points (terminals 85 to 90), the regulating curves 1 to 7 can be preselected. The change-over contacts of regulating curves 8 and 9 take precedence over this type of change-over commutation. As long as the respective relay combination is activated, the system remains on the corresponding regulating curve.

<table>
<thead>
<tr>
<th>Regulating curve</th>
<th>Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>81-82</td>
</tr>
<tr>
<td>No preselection</td>
<td></td>
</tr>
<tr>
<td>Curve 9</td>
<td></td>
</tr>
<tr>
<td>Curve 8</td>
<td></td>
</tr>
<tr>
<td>Curve 7</td>
<td></td>
</tr>
<tr>
<td>Curve 6</td>
<td></td>
</tr>
<tr>
<td>Curve 5</td>
<td></td>
</tr>
<tr>
<td>Curve 4</td>
<td></td>
</tr>
<tr>
<td>Curve 3</td>
<td></td>
</tr>
<tr>
<td>Curve 2</td>
<td></td>
</tr>
<tr>
<td>Curve 1</td>
<td></td>
</tr>
</tbody>
</table>
5.2. Analog outputs

The analog output unit has four channels. The channels are used for output of values measured in respect of system pressure, bowl speed and differential speed. Provided there is a fully hydraulic system, the value measured in respect of the electrical motor’s power is additionally indicated in the output.

All outputs are configured as 4 – 20 mA current outputs. If not otherwise specified in the order, the following standard scaling versions are supplied by the manufacturing plant with respect to 4 – 20 mA.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Range of values</th>
</tr>
</thead>
<tbody>
<tr>
<td>System pressure</td>
<td>0 – 250 bar</td>
</tr>
<tr>
<td>Power (full hydraulic only)</td>
<td>0 – 250 kW</td>
</tr>
<tr>
<td>Bowl speed</td>
<td>0 – 5000 rpm</td>
</tr>
<tr>
<td>Differential speed</td>
<td>0 – 50 rpm</td>
</tr>
</tbody>
</table>

Negative scroll speed values cannot be processed.

The ideal input resistance of the receiving equipment is 100 Ω. However, it is possible to operate within the range of 50 – 500 Ω.

The four channels are free of potential. The reference potential of every channel corresponds in each case to the same mass (ground).

**Take care:** If outputs free of potential are required, suitable transducers have to be used.

**Note:** On special request, other ranges of output signals are applicable.

These output signals cannot be used, if a configuration with an external amplifier is selected.

**Function control**

The output currents may be measured directly between the mass (ground) and the respective output terminals. In case of line breakdown or disconnection, the current may drop below 4 mA, but otherwise it should never be allowed to occur outside the range of 4 – 20 mA.
5.3. Visualizing

Visualizing is used for display and adjustment of the regulating curves relating to the CVC display and control system. Visualizing allows modification of all key parameters of the regulating process. Graphic adjustment of regulating curves is made possible with the help of reference points. The values of modified parameters are continuously stored by the CVC control system so that no visualizing is anymore necessary for the normal standard mode of operation.

For visualizing, commercially available compatible personal computers having at least one free serial interface are suitable as hardware. Alternatively, a plug-in board making possible visualizing can also be supplied for the PC. Connection to the CVC control unit is ensured via a serial interface.

Especially for monitoring, a large-scale display unit is available, whereby the operating data referring to the centrifuge can be read off with ease even at a considerable distance.

Observing the measured values is made possible by an integrated recorder system, whereby it is possible to observe the single measured values during the period of the last two minutes elapsed. Alle diagrams may be printed out or reproduced at any time by a connected printer or plotter.

In case of CVC systems with bowl control visualizing automatically indicates also the power (performance).
5.4. Profibus

5.4.1. General Data of the Profibus

As an aid to the engineer planning to set up and how to dimension a profibus system, the details shown below are to be taken into account. According to the profibus RS485 specifications, a maximum of 32 participants may be connected to a bus segment. In order to accept more participants, it is necessary to submit the system to segmentation. Repeaters are electrically interconnecting bus segments, ensuring amplification and refreshing of data signals. Additionally, repeaters may be used for the galvanic separation of bus segments or sections.

- Number of participants in a system fully completed for utilization of data: DP, 126 (addresses from 0 .. 125)
- Number of participants per individual segment including repeater: 32
- Transmission rates: 9.6, 19.2, 45.45, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 kBit/s
- Number of segments arrayed in series: Depends on repeaters used and the bus parameter set.
5.4.2. Selection of the transmission line of Profibus

As per EN 50 170 part 8-2, the bus line is specified as conductor type A which should correspond to and comply with transmission parameters contained in the chart shown below. Though it is also described in EN 50 170, the conductor B is obsolete and should not be used anymore. Also available are standard bus lines, whose jacket consists of material free from halogen (FRNC). For use by the foodstuff and luxury food industry etc., conductors with PE-jacket are available.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Conductor type A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft resistance in Ω</td>
<td>135 .. 165 at a frequency of 3 – 20 MHz</td>
</tr>
<tr>
<td>Operating capacity (pF/m)</td>
<td>&lt;= 30</td>
</tr>
<tr>
<td>Loop resistance (Ω/km)</td>
<td>&lt;= 110</td>
</tr>
<tr>
<td>Wire diameter (mm)</td>
<td>&gt; 0.64 *</td>
</tr>
<tr>
<td>Wire cross section (mm²)</td>
<td>&gt; 0.34 *</td>
</tr>
</tbody>
</table>

* The involved wire cross sections must correspond to the connecting possibilities at the bus connector.

Based on the specified line parameters of the standard conductor (conductor type A), the length expansion values of a bus segment as shown below do apply to the transmission speeds in each single case:

<table>
<thead>
<tr>
<th>Transmission speeds in kBit/s</th>
<th>9.6</th>
<th>19.2</th>
<th>45.45</th>
<th>93.75</th>
<th>187.5</th>
<th>500</th>
<th>1500</th>
<th>3000</th>
<th>6000</th>
<th>12000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. segment length in m</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>1000</td>
<td>400</td>
<td>200</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Take care: Within one and the same Profibus-DP/FMS system, only one transmission rate of such a kind can be selected, which is suitable for and supported by all field equipment units. Depending on the selected transmission rate, the segment lengths indicated do apply.
5.4.3. Bus connector

A bus connector connects the bus cable to a specific station. Bus connectors (i.e. bus terminals) are available with diverse protective systems and in various designs (structural forms). Basically, the selection of the most suitable connector depends on the space available at the place where the bus participant is located.

As far as possible, you should use straight bus connectors.

The text of EN 50170 part 2 proposes the use of a 9-pole D-SUB connector. Depending on the protective system and the application mode of the field equipment, other available connector combinations are also allowed.

<table>
<thead>
<tr>
<th>Pin Nr.</th>
<th>Signal</th>
<th>Implemented in the CVC system</th>
<th>Meaning/significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shield</td>
<td></td>
<td>Shield, protective earthing</td>
</tr>
<tr>
<td>2</td>
<td>M24</td>
<td></td>
<td>Mass (ground) of the 24V output voltage</td>
</tr>
<tr>
<td>3</td>
<td>RxD/TxD-P</td>
<td>*</td>
<td>Reception-/transmittal data- Plus, B-conductor</td>
</tr>
<tr>
<td>4</td>
<td>CNTR-P</td>
<td></td>
<td>Repeater control signal</td>
</tr>
<tr>
<td>5</td>
<td>DGND</td>
<td>*</td>
<td>GND of voltage supply</td>
</tr>
<tr>
<td>6</td>
<td>VP</td>
<td>*</td>
<td>+5V of voltage supply</td>
</tr>
<tr>
<td>7</td>
<td>P24</td>
<td></td>
<td>+24V output voltage</td>
</tr>
<tr>
<td>8</td>
<td>RxD/TxD-N</td>
<td>*</td>
<td>Reception-/transmittal data- minus, A-conductor</td>
</tr>
<tr>
<td>9</td>
<td>CNTR-N</td>
<td></td>
<td>Repeater control signal</td>
</tr>
</tbody>
</table>

The shield (cover) of the conductor must be connected to the functional earth (as a rule, this is the conductive housing) of the connected equipment, thus avoiding to introduce EMC-related disturbances into the equipment itself. For this purpose, the conductor’s shield in the connector has to be connected by large-surface mode to the metal housing of the D-SUB connector and the functional earth. In this respect, the involved bus connector plug must have a conductive low-resistance connection to the conductor’s shield. The data transmission technology of the serial bus system based on a twisted two-wire conductor with connected shield is described and defined in the specification referring to the disturbance-proof RS-485 interface. It is possible to insert terminations of the bus conductor at every site of a bus participant..

Due to the capacitative load of participants and the line reflections arising thereby, connectors with integrated line inductance should be used. Bus connectors with integrated line inductance should not be installed without a corresponding field equipment unit, as otherwise the required opposite counter-capacitance is lacking.

For the wiring in the connector, the red conductor is mostly used for line B, whereas for the data transmission line A, the green conductor is used.
5.4.4. Laying of lines and installing bus connector plugs

In order to allow single control of field equipment units during start-up of the system, it is advisable to use, within a segment, at least one bus connector which contains an additional interface relating to programming apparatus. Laying of the bus line and connecting the bus connectors is to be carried out carefully so as to exclude right from the start sources of faults arising later on.

Prior to connecting the bus cable to the bus connector you should inform yourself of the mechanical properties of the connector. As a rule, data conductors are marked in the connector with A and B. Take care that the same colour of line is always without fail connected to the same letter at each participant’s site, both regarding the incoming and the outgoing line. However, there is no directive which colour is to be connected to a given letter, but this should individually be prescribed for each system involved. As to using the colours green and red for the data transmission wires, the practice now prevails to connect conductor A to GREEN and conductor B to RED. In many cases, it was deemed advisable to draw up and design a complete documentation without any gaps of the lines laid. This also includes recording the lengths of lines between individual field equipment units. These lengths can easily be ascertained by ohmic measurement at the line. Each profibus line has a loop resistance of \( 110 \, \Omega/\text{km} \). The line shield is to be connected in a large-surfaced way to the shield clamp concerned. The shield clamp and the connector’s housing have to be connected in a conductive manner. At the beginning and at the end of a bus segment (and in no other place), a terminal resistor has to be inserted.

The bus terminal resistor between the two data lines corresponds to approx. \( 220 \, \Omega \). Using a measuring instrument, it is possible to verify that this resistance value is also indicated in a dead state at pins 3 and 8 whenever ohmic measuring takes place.
5.4.5. Setting of the bus number (slave adress) at the CVC

The setting (adjustment) of the bus number (slave adress) by means of the profibus is not assisted.

How to get CVC into service mode

At the rear of the CVC equipment, under the protective cap, you'll find the CVC’s service switch, which you now have to set upwards.

After 10 seconds the CVC control unit automatically changes over to the service mode.
Setting of bus number (slave adress)

While operating in the service mode, the following display text is indicated on the CVC control unit.

![Display Text](image)

Procedure to set (adjust) the bus number.

Starting from the above display, you press in the service mode the arrow key until you obtain the following display text.

![Display Text](image)

Now please press the Enter key.

![Display Text](image)

Now you can adjust the bus number of the CVC by means of the arrow keys. The lowest possible address which can be set is 2, the highest is 125.

After having carried out the modifying adjustment, you again set the service switch at the equipment’s rear side on “off”.

Afterwards, you have to acknowledge the respective value by pressing the Enter key.

Thereupon, the system restarts again, taking over the bus number newly set.
5.4.6. Data description

General matters

For project designing by means of the CVC display and control system, you will require a GSD-data base, which may be obtained from the company Viscotherm or directly from the Internet Server [www.viscotherm.ch](http://www.viscotherm.ch). The following data bases are used for project designing:

- CVC_04F1.GSD  
  Equipment’s master data regardless of language (English)
- CVC_04F1.GSE  
  Equipment’s master data dependent on language (English)
- CVC_04F1.GSG  
  Equipment’s master data dependent on language (German)
- CVC_04F1.GSF  
  Equipment’s master data dependent on language (French)
- CVC_04F1.GSS  
  Equipment’s master data dependent on language (Spanish)
- CVC_04F1.GSP  
  Equipment’s master data dependent on language (Portuguese)
- CVC_04F1.GSI  
  Equipment’s master data dependent on language (Italian)
- CVC-XXXN.BMP  
  Bitmap data base for display in the project designing software (coloured)
- CVC-XXXS.BMP  
  Bitmap data base for display in the project designing software (b&w)

As a start-up support a help function is available, indicating at any time the current status of Profibus Slaves.

5.4.6.1. Structuring of data

On integrating the equipment into the project designing software, the configured modules are copied into it, as hereinafter described:

<table>
<thead>
<tr>
<th>Block</th>
<th>Length</th>
<th>Contents</th>
<th>Master function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13 words</td>
<td>Status and measured value</td>
<td>Read off</td>
</tr>
<tr>
<td>2</td>
<td>1 Byte</td>
<td>Regulating curve</td>
<td>Write</td>
</tr>
<tr>
<td>3</td>
<td>6 Bytes</td>
<td>Values set</td>
<td>Write</td>
</tr>
<tr>
<td>4</td>
<td>7 Bytes</td>
<td>Feedback acknowledgement</td>
<td>Read off</td>
</tr>
</tbody>
</table>

With the first 13 words, the CVC’s input signals are transmitted, comprising the status signals, the bowl speed, the scroll speed, the differential speed, the system pressure, the calculated torque as well as the analog signals specifically adjusted to respective applications. The application-specific measured values correspond to specific scalings tuned to operator’s needs.

In the following the measuring and control values are listed in ascending order. The values set with respect to the CVC contain the parameters for the regulating curve, the base speed, the control pressure, the regulating stiffness (slope) as well as the values for the pressure switches (gauges) p2 and p3. Whenever a hydraulic drive is used, it is possible to transmit also the bowl drive speed by the aforesaid set value.

The feedback acknowledgement messages of the CVC contain the identical parameters as do the set values, and they are used as basis for modifying adjustments of parameters. The CVC monitors the set values, while divergences from the limiting values are advised in the feedback message by returning at the same time indication of the respective minimum and maximum values. Whenever a hydraulic drive is used, the value referring to it is also returned.
### Measured values

#### Status

By this data word, the current status of the CVC equipment is outputted. In every instance, only the error code with top priority in importance is transmitted. This simplifies the fault finding search within the system. This status word serves for evaluation provided that there is no extended diagnostics function available in the higher-ranked system.

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
<th>*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No fault is existing</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cable break hydraulic pressure</td>
<td>E1</td>
</tr>
<tr>
<td>2</td>
<td>CVC is in the service mode</td>
<td>I</td>
</tr>
<tr>
<td>3</td>
<td>Cable break bowl speed</td>
<td>E2</td>
</tr>
<tr>
<td></td>
<td>This error message occurs only if troubles do arise while receiving measured signals when the CVC is “on” and working and during the measuring process. This error code is not stored.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cable break scroll speed</td>
<td>E2</td>
</tr>
<tr>
<td></td>
<td>This error message occurs only if troubles do arise while receiving measured signals while the CVC is “on” and working on the measuring process. This error code is not stored.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Standstill bowl speed</td>
<td>I</td>
</tr>
<tr>
<td>6</td>
<td>Standstill scroll speed</td>
<td>I</td>
</tr>
<tr>
<td>7</td>
<td>Trouble regarding feeding of sensors</td>
<td>E1</td>
</tr>
<tr>
<td>9</td>
<td>Pressure switch p3 limit</td>
<td>I</td>
</tr>
<tr>
<td>10</td>
<td>Pressure switch p2 limit</td>
<td>I</td>
</tr>
<tr>
<td>11</td>
<td>Trouble feeding of valves</td>
<td>E1</td>
</tr>
<tr>
<td>12</td>
<td>Cable break power</td>
<td>E1</td>
</tr>
<tr>
<td>20</td>
<td>Cable break channel 1</td>
<td>E2</td>
</tr>
<tr>
<td>21</td>
<td>Cable break oil temperature</td>
<td>E2</td>
</tr>
<tr>
<td>24</td>
<td>Cable break channel 2</td>
<td>E2</td>
</tr>
<tr>
<td>25</td>
<td>Cable break channel 3</td>
<td>E2</td>
</tr>
<tr>
<td>26</td>
<td>Cable break channel 4</td>
<td>E2</td>
</tr>
<tr>
<td>27</td>
<td>Cable break channel 5</td>
<td>E2</td>
</tr>
<tr>
<td>38</td>
<td>Change oil</td>
<td>E2</td>
</tr>
<tr>
<td>39</td>
<td>Perform overhaul Rotodiff</td>
<td>E2</td>
</tr>
<tr>
<td>48</td>
<td>Cable break distance measuring pump differential drive. Occurs only in connection with specific hydraulics.</td>
<td>E1</td>
</tr>
<tr>
<td>49</td>
<td>Cable break distance measuring pump bowl drive (full hydraulic). Occurs only in connection with specific hydraulic system.</td>
<td>E1</td>
</tr>
<tr>
<td>61+n</td>
<td>Short circuit digital channel Dn [n = channel number]</td>
<td>E2</td>
</tr>
<tr>
<td>71+n</td>
<td>Short circuit digital channel Dn [n = channel number]</td>
<td>E2</td>
</tr>
</tbody>
</table>

*) Type of message  
E1 = Grave fault  
E2 = Error message  
I = Information indication
**Bowl speed**
The second value to be transmitted is the bowl speed. The value transmitted directly corresponds to the speed expressed in revolutions per minute.

**Scroll speed**
The value transmitted directly corresponds to the speed expressed in revolutions per minute.

**Differential speed**
This is transmitted as an integral number with one digit after decimal point. This means for example that a value of 74 transmitted corresponds to an actual differential speed of 7.4 revolutions per minute.

**System pressure**
The value transmitted corresponds directly to the measured pressure in bar.

**Torque**
The theoretical torque is indicated, which is calculated by a simplified procedure out of the system pressure. The value is transmitted directly in Nm. The calculating formula is shown opposite.

\[ M_{\text{th}} = \frac{P \cdot V_s}{10 \cdot 2\pi} = \frac{\text{Pressure} \cdot \text{Swapt volume}}{10 \cdot 2\pi} \]

**Power**
This input requires an external transducer, which is mandatory in case of a hydraulic bowl drive (regulation and monitoring of performance). The input range is set from 0 to 250kW. The power is directly indicated in kW in the output.

**Oil temperature**
The value transmitted corresponds directly to the measured oil temperature. An appropriate oil temperature sensor must belong to the equipment. Input parameters are preset at the sensor mounted on the pump unit prior to delivery of the equipment. Modification of parameters by readjustment is only possible in the service mode.

**Channel 1 (analog input)**
This input can be parametrized according to specific application requirements. If no parametrizing is selected, the value 0 is indicated in the output. The input signal used has to conform to the range 4-20 mA. Adjustment of input parameters will be explained later on in the text.

**Channel 2 (analog input)**
This input can be parametrized according to specific application requirements. If no parametrizing is selected, the value 0 is indicated in the output. The input signal used has to conform to the range 4-20 mA. Adjustment of input parameters will be explained later on in the text.
Channel 3 (analog input)
This input can be parametrized according to specific application requirements. If no parametrizing is selected, the value 0 is indicated in the output. The input signal used has to conform to the range 4-20 mA. Adjustment of input parameters will be explained later on in the text.

Channel 4 (analog input)
This input can be parametrized according to specific application requirements. If no parametrizing is selected, the value 0 is indicated in the output. The input signal used has to conform to the range 4-20 mA. Adjustment of input parameters will be explained later on.

Channel 5 (analog input)
This input can be parametrized according to specific application requirements. If no parametrizing is selected, the value 0 is indicated in the output. The input signal used has to conform to the range 4-20 mA. Adjustment of input parameters will be explained later on in the text.

Take care: All reserve channels are scanned with a resolution of 10 Bits, yielding an accuracy of 1024 Bits. Only values consisting of integral numbers can be shown in the output.
Example 1: A pressure sensor comprising 0-400 bar with 4-20 mA may be configured for an output value of 0-4000.
Example 2: A flowmeter with capacity of 0-20 l may be configured for an output value of 0-2000.
5.4.6.3. Regulating curve

The databyte for change-over commutation to the active regulating curve contains a release bit for enabling local operational control. As soon as the bit "take over set data" has been set, the set values are taken over and stored.

The release bit enabling local operational control may only be set and activated upon a request for local control, see feedback acknowledgement. Should local control have to be locked and inhibited, the respective bit has generally to be set on 0.
5.4.6.4. Values set

The first 5 data bytes contain the base speed, the control pressure, the regulating stiffness (control slope) and the pressure gauge values referring to p2 and p3. All these values are indicated as a percentage [0 – 100 %].

Take care: These values refer to the regulating curve actually selected. After change-over commutation of the active regulating curve, it is necessary to read first of all the values indicated in the feedback acknowledgement. In this way, the currently prevailing status of the system can be determined.

![Data Byte Table]

If the selected regulating curve corresponds to a nonlinear curve, the regulating stiffness (control slope) cannot be modified by readjustment. In this case, the feedback acknowledgement indicates the value 0. The curves 5, 6 and 7 have at any rate been preset by the manufacturing plant as nonlinear curves. The pressure switch (gauge) p2 is used to shut down the product feed. Pressure switch p3 is used to shut down the bowl drive. In the CVC 600 system, both pressure switches have the form of relay points, i.e. contacts, thus ensuring direct integration into the safety circuit and control.

Whenever a hydraulic bowl drive is used, the 6th data byte “bowl speed” is added. However, this value exerts no influence unless a hydraulic bowl drive is used, as mentioned before. By means of the said 6th byte, a target value of 0 – 100% is set for the bowl drive.
5.4.6.5. Feedback acknowledgement

The feedback acknowledges the values set by the CVC. Normally, these values are identical to those set by the master system. However, if a value set by the master system should not be workable, the CVC feedback indicates the admissible minimum or maximum value. In the data byte 0, the number of the active regulating curve as well as a bit for requesting local control is included in the transmission.

Once the bit „request for local control“ has been set, the CVC system anticipates setting of the bit „release of local control“ in connection with the values set. Only after this bit has been set, it is possible to perform local adjustments at the CVC system.

Once the bit „external control“ has been set, it is no longer allowed to perform adjustments via the Profibus. This bit is set whenever adjustment occurs from a visualizing mode or if the equipment’s relay points (contacts) are used to preselect a curve.

The bits referring to the regulating curve are outputting directly the numbers of the regulating curve set. Should an invalid number have been selected for a certain regulating curve, the CVC does not provide change-over commutation of the said regulating curve. The feedback acknowledgement then continues to indicate the current regulating curve. In this case, no modifications/adjustments are accepted.

With respect to the values referring to control pressure and the pressure gauges p2 and p3, divergences between the set values and the acknowledged values may occur in certain cases, based on CVC-internal storage and calculating processes. This is because the pressure points are only stored with an accuracy of 2 bar in the CVC system. However, the functioning of the regulating curves is not affected thereby, as these values are interpolated internally and are thus provided with an almost infinite accuracy. Whenever the system is based on a full hydraulic drive, the undermentioned byte is added to serve as a feedback. The value of the bowl speed may range from 0 to 100%.
5.4.6.6. Limitation of feedback signals

All limitations are carried out by the CVC system. Values contained in the feedback signals correspond to the limited values. Calculation of limitations is based on the limits (limiting values) of the system itself. These limits are preset by the manufacturing plant.

Regulating curve
Only the regulating curves 1 to 9 are admissible, whereas all other values set are simply disregarded. The manufacturing plant did already preprogramme regulating curve 8 to serve as working curve and regulating curve 9 to serve as cleaning (flushing) curve. However, there are no restrictions in respect of utilizing the regulating curves. Please consult the CVC operating instructions for information about the various application modes of the preset regulating curves.

Base speed
Lower limit:
0% corresponds to a preset minimal difference. In most cases, this item is set at a difference of 1 rotation. This minimal limit stop is required for mechanical and hydraulic reasons.
Upper limit:
As is shown above, the regulating curve 9 allows running the full differential speed, as this curve does not work over the whole range of pressure. By contrast, the regulating curve 8 has the function of a working curve and is designed to cover the whole range of pressure while on the other hand the full range of the differential speed is not workable.
**Control pressure (pressure control)**

Lower limitation:
0% corresponds to a pressure of 0 bar which means that the CVC system commences the regulating process immediately after start-up.

Upper limitation:
Maximum control pressure must be set in such a way as to involve a minimum control slope (regulating stiffness).
A further restriction requires the control pressure to be at least 30 bar below the initial point (setpoint) of pressure control. This means that the value of 100% cannot be set. However, in order to comply with the same scaling as applied to the pressure switches (gauges), the maximum pressure is defined as 100%.

---

**Control slope (regulating stiffness)**
Should the selected regulating curve correspond to a nonlinear curve, no modifying adjustment of the regulating stiffness (control slope) is possible. In this case, the value 0 is indicated.
Pressure switch p2 (pressure gauge)
Lower limitation:
The pressure switch p2 has to be set not lower than at 20 bar. Setting below this value is impossible because of safety measures regarding operating faults.
Upper limitation:
It is allowed to set the pressure gauge p2 at the utmost 6 bar below the value of pressure gauge p3. This safety measure has been integrated for the sake of ensuring the system’s security. It does not make sense to switch off the bowl drive (p3) before having shut down the product feed (p2).

Pressure switch p2 (pressure gauge)
Lower limitation:
The pressure gauge p3 has to be set at least 6 bar higher than pressure gauge p2. This safety measure has been integrated for the sake of ensuring the system’s security.
It does not make sense to switch off the bowl drive (p3) before having shut down the product feed (p2).
Upper limitation:
It is allowed to set the pressure gauge p2 at the utmost 6 bar below control pressure. Pressure control is strictly an emergency operation. In such a case, it is prohibited to further increase the bowl drive, and neither is it possible to feed products to the installation.

Bowl drive (full hydraulic and external amplifier only)
No limitations do exist for the bowl drive. A value between 1 and 100% can be set.
5.4.7. **Diagnostics**

The diagnostical messages of the CVC have been designed in conformity with the profibus standards. If a fault event takes place, an extended diagnostics is transmitted whenever a request for diagnostics is made. Once the fault or trouble has been eliminated, a normal diagnostics message (standard diagnostics) is again transmitted.

5.4.7.1. **Standard diagnostics**

![Diagram of standard diagnostics](image-url)
5.4.7.2. Extended diagnostics

In a fault event, the bit Diag.ext_diag is set. In addition to the standard diagnostics, the following octets are transmitted.
5.4.8. **Configuration of analog input channels**

For the analog input channels, a help display function is available, which indicates the current value of the input.

5.4.8.1. **Configuration with profibus DP**

By means of the project designing tool, the input channels of the CVC can be parametrized. The example of the Siemens Step7 development shows the simple manner in which parametrizing may be performed.

With the first line „parametrization“, selection is made as to whether the equipment will be parametrized by means of profibus or in the service mode. If profibus is selected, the adjustments having been made in the service mode are overwritten.

Using the parameters „Channel [Nr] off/on“, the respective channel is switched off or on.

Using the parameters „Channel [Nr] range“ the range of the signal is indicated. The CVC equipment is provided with an internal, linear converting function (linearizing chart) ensuring output on a scaled factor.

The input range always commences with 0 (4mA), proceeding onward to the value (20mA) being set.
5.4.8.2. Configuration in the service mode

In order to configure the inputs, the service mode must be implemented first of all (see item „Bring CVC into the service mode“).

**Take care:** Configuring by means of profibus is not allowed, as this would overwrite parametrizing in the service mode.

**Procedure for setting the bus number**

Press in service mode the arrow key until you get the following display text.

```
SERVICEMODE
DIRECT MENU
CONFIGURATION ANALOG
```

Press now the Enter key and select with the arrow keys the channel to be set.

```
SERVICEMODE
SELECT CHANNEL
CHANNEL 2
```

Press now the Enter key and select with the arrow keys the alternative whether to switch the channel on or off.

```
SERVICEMODE
CHANNEL 2
CHANNEL ON
```

Press now the Enter key in order to acknowledge the input.
Once you have switched off the channel, the standard display screen of the service mode is again shown. After you have switched on the channel, input of the range is expected to occur on the next display screen.

![Servicemode screen](image)

You should now use the arrow keys \[\uparrow\downarrow\] in order to adjust the range of the channel. If you wish to set further channels, then please press the Enter key \[Enter\].

After having adjusted all channels, you now set the service switch at the equipment’s rear side again on „off“.

Only afterwards, you acknowledge the value by means of the Enter key \[Enter\].

Thereafter, the system starts anew and the set values are taken over.
### 6. Diagram

#### 6.1. Diagram overview

<table>
<thead>
<tr>
<th></th>
<th>Only Rotodiff drive</th>
<th>Full hydraulic</th>
<th>External amplifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2 Sensor wiring</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.3 Sensor wiring full hydraulic</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.4 Sensor wiring with external amplifier</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5 Enable bowl</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6.6 Valve wiring Rotodiff drive</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.7 Valve wiring full hydraulic</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.8 Pressure switch / mains current feed</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.9 Relay remote control</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.10 Analog outputs</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6.11 Temperature measurement / analog inputs</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.12 Safety pump unit</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.13 Monitoring, safety full hydraulic</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.2. Sensor wiring
6.3. Sensor wiring full hydraulic
6.4. Sensor wiring with external amplifier
6.5. Enable bowl
6.6. Valve wiring Rotodiff drive

- Proportionalventil (Proportional valve)
- Geregeltes Ventil (Regulated valve)

Diagram showing connections and wiring for the hydraulic system with labeled components such as Hydraulik-Aggregat (Pump unit), Klemmenkasten (Junction box), and CVC 600.
6.7. Valve wiring full hydraulic
6.8. Pressure switch / mains current feed
6.9. Relay remote control
6.10. Analog outputs

In the configuration with an external amplifier the analog outputs are not available.
6.11. Temperature measurement / analog inputs
6.12. Safety pump unit
6.13. Monitoring, safety full hydraulic
6.14. **Wiring recommendations**

The wiring diagrams provide details on maximum cable length, cable size and cable screening. It is essential to adhere to them.

**Most important points:**

1. Under no circumstance may CVC-… cables be laid alongside 220/380V mains cable. When CVC-… and voltage cable have to follow the same path, one must make sure that they are never less than 15 to 20 cm apart (as prescribed by VDE 0113 / EN 60204 rules).

2. Where the use of screened cables is indicated in the wiring diagram, this has to be done without exception. Wire sections of less than 1mm² should not be used. The cable screening must be secured to terminal provided and insulated at the other end to avoid any short to earth. Cables between junction box and the CVC-… basic unit must not be interrupted or carry intermediate connections since this would allow external signals to influence the system.

3. Solenoid valve wiring and other signal wires should never be used in the same multicore screened cable as CVC-… signal wires.

4. Only by observing all these rules are a satisfactory functioning of the CVC-… system secured. The VDE 0113 / EN 60204 rules contain further indications on wiring of machine equipment. Installation personnel should also observe electromagnetic compatibility requirements.
6.15. Engineering hints external amplifier

For use with an external amplifier (Frequency converter), for the systems there are the same rules in use like for Viscotherm full hydraulic systems.

The output signal from the variable frequency drive (4-20mA) can given as power-, torque- or percent value. The range of the input must be adjusted by Viscotherm. From a preseted value, the bowl speed were decreased automaticly. This is to prevent an overload of bowl drive motor.

If you order a CVC control unit for use with an external amplifier we need the following parameters.

- Scaling of measurement input and type (power, torque or percent)
- Setpoint for the regulation in percent to the scaling of measurement input
7. Compatibility

The design of the CVC600 ensures complete compatibility with respect to the display and control systems hitherto delivered by VISCOTHERM. The following systems are directly interchangeable:

- EMSEPS
- EC240
- CVC410
- CVC510

All terminal numbers of predecessor systems can directly be wired to terminal numbers of the CVC600. CVC410 and CVC510 systems are using the same plug connectors; the cables do not have to be separated from the plug connectors.

Exceptions

As regards EMSEPS and EC240 control devices provided with inputs for external selection of curves, you should take note that with EMSEPS and EC240 change-over commutation takes place by impulse. With CVC600, the contact for the selected curve must continuously sit close. The regulating curve changes over only after 4 seconds.

Using EMSEPS control devices in connection with fully hydraulic units, you should take note that the release input of the CVC600 cannot any longer be controlled directly with 110V or 230V. In such a case, an external relay has to be placed at terminals 91 and 92.
8. Rear view

F1 Fuse system pressure (50mA)
F2 Fuse power metering (50mA)
F3 Fuse valves feed (2A)
F4 Fuse sensor feed (200mA)
F5 Fuse oil temperature sensor (50 mA)**
F6 Fuse channel 1 (50mA)
F7 Fuse channel 2 (50mA)
F8 Fuse channel 3 (50mA)
F9 Fuse channel 4 (50mA)
F10 Fuse channel 5 (50mA)
H1 LED bowl
H2 LED bowl
H3 LED scroll
H4 LED scroll
H5 LED valves feed
H6 LED sensors feed
H7 LED ProfibusDataExchange
S1 Service switch
S2 Profibus termination
S3 Language commutation
X1 Connector visualizing RS232
X2 Connector profibus DP
X3 Connector feed (L, N, E)
X4 Connector analog outputs (21-28)
X5 Connector sensors (1-14)
X6 Connector pressure switch (72-76)
X7 Connector digital outputs (120-131)
X8 Connector valves (51-68)
X9 Connector analog inputs (101-116)
X10 Connector digital inputs (81-92)
X11 Connector digital inputs (181-188)
X12 Jumper Namur bowl
X13 Jumper Namur scroll

* used only in connection with full hydraulic
** used only in connection with oil temperature measurement
9. **Installation of switch cabinet (control box)**

- Remove the clamp clips at the side of the equipment by unscrewing the 6 screws (a).
- Push the equipment into the switch cabinet prepared in advance – see section.
- Fix both side clamps (e) with the screws (a) to the CVC casing.
- Fix the top and bottom clamps (f) with the screws (c) to the CVC casing.
- Use the straining screws (b) to fix the CVC control unit to the control cabinet.
10. Language selection

The language selector switch is situated close to the connectors for serial communication and the profibus at the equipment’s rear side. After change-over commutation to a specific language, the voltage supply (current supply) of the CVC must be switched off and then on again in order to activate and implement the new language.

<table>
<thead>
<tr>
<th>Switch position</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>German</td>
</tr>
<tr>
<td></td>
<td>English</td>
</tr>
<tr>
<td></td>
<td>French</td>
</tr>
<tr>
<td></td>
<td>Portuguese</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>Dutch</td>
</tr>
<tr>
<td></td>
<td>Norwegian</td>
</tr>
<tr>
<td></td>
<td>Italian</td>
</tr>
</tbody>
</table>
11. Troubleshooting

As an auxiliary for identification of troubles or faults, various help display functions are available. Please consult in this respect the section Help display functions.

<table>
<thead>
<tr>
<th>Characterization/aspect</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Background illumination of display is dark and no value is indicated on the regulating curve | - Check mains feed  
- Terminals L, N, E |
| Regulating curve display is 0 | - Check mains feed  
- Terminals L, N, E |
| Values on display screen cannot be read | - Check mains feed  
- Terminals L, N, E |
| Display occurs in the wrong language | - Change-over of language (see language selection)  
- Switch equipment off and on again |
| Rotodiff’s differential speed does not move to basic differential speed set | - Speed regulator corrects within a band of ±10% of the maximum differential speed, which corresponds to ±100% of speed regulator.  
- Speed regulator starts running only after a minimum of 500 rpm  
- Switch on help display function “Diagnostics speed regulator”.  
- If the speed regulator is in the fringe range  
  -> check filter and oil quality, possibly oil change to be performed as per directives in operating instructions of pump unit. |
| Rotodiff’s differential speed is higher than the basic differential speed set | - Speed regulator corrects within a band of ±10% of the maximum differential speed, which corresponds to ±100% of speed regulator.  
- Speed regulator starts running only after a minimum bowl speed of 500rpm  
- Check whether control pressure p1 is set higher than the pressure actually measured. Otherwise the system is already working in the regulating mode. |
| Display of: SERVICE MODE | - The equipment is working in the service mode.  
- Service switch on the rear side to be reversed.  
- Remove serial data cable  
- Switch equipment off and then on again |
| Display of: KEYBOARD LOCKED | - Operational control locked by governing system  
- Operational control locked by visualizing |
| Display of: EXT. ADJUSTMENT | - Operational control by means of visualizing; the regulating curves cannot be commutated. |
| Display of: EXTERNAL CURVE SEL. | - Preselection of curves occurs by relay points; the regulating curves cannot be commutated. |
| Display of: α NOT ADJUSTABLE | - The currently active regulating curve is nonlinear; with nonlinear regulating curves, the adjustment of the control slope (regulating stiffness) cannot be changed. |
| Display of: OIL CHANGE SERVICE | - The operating hours of the pump unit require a change of oil (see documentation of pump unit)  
- Acknowledgement of oil change (see acknowledge oil change) |
| Display of: OVERHAUL ROTODIFF | - The Rotodiff’s operating hours require an overhaul of the Rotodiff (see documentation of Rotodiff)  
- Acknowledgement of overhaul (see acknowledge overhaul Rotodiff) |
<table>
<thead>
<tr>
<th>Characterization/aspect</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display of:</strong></td>
<td><strong>Remedy</strong></td>
</tr>
</tbody>
</table>
| **FAULT ON SENSORS**   | **Sensor fuse** (F4, 200mA) to be checked  
- Connector X5, pull off terminals 1 – 14  
- Connector X9, pull off terminals 101 – 116  
- Connector X10, pull off terminals 81 – 92  
- Connector X11, pull off terminals 181 – 188  
- Now the connectors have to be plugged in again one after the other until the fault does again occur; then the fault has to be remedied/eliminated at the involved connector, cable or sensor |
| **Display of:**        | **Valve fuse** (F3, 2A) to be checked  
- Connector X8, pull off terminals 51 – 68  
- Connector X7, pull off terminals 120 – 131  
- Connector X6, pull off terminals 72 – 76  
- Now the connectors have to be plugged in again one after the other until the fault does again occur; then the fault has to be remedied/eliminated at the involved connector, cable or sensor |
| **Display of:**        | **Cable break of pressure sensor may be involved**  
- **Terminals 1 to 3**  
- Check cable and sensor  
- Input current at terminal 2 should now be measured  
- **Fuse F1** (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:**        | **Possibility of cable break of bowl initiator**  
- Use help display function **scroll display**  
- **Terminals 7 to 10**  
- Check cable and initiator  
- Check interspace (distance) of initiator |
| **Display of:**        | **Possibility of cable break of scroll initiator**  
- Use help display function **scroll display**  
- **Terminals 11 to 14**  
- Check cable and initiator  
- Check interspace (distance) of initiator |
| **Display of:**        | **Possibility of cable break of bowl initiator**  
- Use help display function **scroll display**  
- **Terminals 7 to 10**  
- Check cable and initiator  
- Check interspace (distance) of initiator |
| **Display of:**        | **Possibility of cable break of scroll initiator**  
- Use help display function **scroll display**  
- **Terminals 11 to 14**  
- Check cable and initiator  
- Check interspace (distance) of initiator |
| **Display of:**        | **Possibility of cable break of bowl initiator**  
- Use help display function **scroll display**  
- **Terminals 11 to 14**  
- Check cable and initiator  
- Check interspace (distance) of initiator  
- Check interspace (distance) of initiator |
| **Display of:**        | **Possibility of cable break of bowl initiator**  
- Use help display function **scroll display**  
- **Terminals 7 to 10**  
- Check cable and initiator  
- Check interspace (distance) of initiator  
- Check interspace (distance) of initiator |
<table>
<thead>
<tr>
<th>Characteristics/aspect</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| **Display of:** CABLEBREAK POWER | - Possibility of cable break between CVC and transducer  
- Terminals 4 to 6  
- Check cable and transducer  
- Input current at terminal 5 now to be measured  
- Fuse F2 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of negative power Values** | - Current transformer at transducer is connected in twisted manner  
- Current transformer connections at transducer to be turned (rotated) |
| **Display of negative power Values** | - Current transformer at transducer is connected to wrong phase  
- Current transformer has to be connected to the first phase |
| **Display of:** CABLEBREAK RESERVE | - Possibility of cable break between CVC and sensor  
- Terminals 4 to 6  
- Check cable and sensor  
- Input current at terminal 5 now to be measured  
- Fuse F2 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:** CABLEBREAK OILTEMP. | - Cable break between CVC and temperature measuring transducer  
- Make use of help display function oil temperature  
- Terminals 101 to 103  
- Check cable and temperature measuring transducer  
- Input current at terminal 102 to be measured  
- Fuse F5 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:** CABLEBREAK CHANNEL 1 | - Cable break between CVC and sensor  
- Make use of help display function input channel  
- Terminals 104 to 106  
- Check cable and sensor  
- Input current at terminal 105 to be measured  
- Fuse F6 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:** CABLEBREAK CHANNEL 2 | - Cable break between CVC and sensor  
- Make use of help display function input channel  
- Terminals 107 to 109  
- Check cable and sensor  
- Input current at terminal 108 to be measured  
- Fuse F7 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:** CABLEBREAK CHANNEL 3 | - Cable break between CVC and sensor  
- Make use of help display function input channel  
- Terminals 110 to 112  
- Check cable and sensor  
- Input current at terminal 111 to be measured  
- Fuse F8 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| **Display of:** CABLEBREAK CHANNEL 4 | - Cable break between CVC and sensor  
- Make use of help display function input channel  
- Terminals 113, 114 and 116  
- Check cable und sensor  
- Input current at terminal 114 to be measured  
- Fuse F9 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
<table>
<thead>
<tr>
<th>Characteristics/aspect</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Display of: CABLEBREAK CHANNEL 5 | - Cable break between CVC and sensor  
- Make use of help display function input channel  
- Terminals 113, 115 and 116  
- Check cable and sensor  
- Input current at terminal 115 to be measured  
- Fuse F10 (50mA) to be checked  
- Is the fuse in the measuring device ok? |
| Display of: CABLEBREAK POSM. 0 | - Cable break between CVC und position sensor Rotodiff pump  
- Make use of help display function Diagnostics Rotodiff  
- Terminals 55 to 58  
- Check cable and sensor |
| Display of: CABLEBREAK POSM. 1 | - Cable break between CVC und position sensor of bowl pump  
- Make use of help display function Diagnostics bowl  
- Terminals 65 to 68  
- Check cable and sensor |
| Display of: CABLEBREAK p3 | - Internal fault CVC |
| Display of: CABLEBREAK p2 | - Internal fault CVC |
| Display of: CABLEBR. COOLINGW.V. | - Cable break between CVC and cooling water valve or cooling water relay  
- Terminals 120 and 121 |
| Display of: CABLEBREAK DO3 | - Cable break between CVC and external relay  
- Terminals 122 and 123 |
| Display of: CABLEBREAK DO4 | - Cable break between CVC and external relay  
- Terminals 124 and 125 |
| Display of: CABLEBREAK DO5 | - Cable break between CVC and external relay  
- Terminals 126 and 127 |
| Display of: CABLEBREAK DO6 | - Cable break between CVC and external relay  
- Terminals 128 and 129 |
| Display of: CABLEBREAK DO7 | - Cable break between CVC and external relay  
- Terminals 130 and 131 |
| Display of: SHORTCIRCUIT p3 | - Internal fault CVC |
| Display of: SHORTCIRCUIT p2 | - Internal fault CVC |
| Display of: SHORTC. COOLINGW.VAL. | - Short circuit between CVC and cooling water valve or cooling water relay  
- Terminals 120 und 121 |
| Display of: SHORTCIRCUIT DO3 | - Short circuit between CVC and external relay  
- Terminals 122 and 123 |
| Display of: SHORTCIRCUIT DO4 | - Short circuit between CVC and external relay  
- Terminals 124 and 125 |
| Display of: SHORTCIRCUIT DO5 | - Short circuit between CVC and external relay  
- Terminals 126 and 127 |
| Display of: SHORTCIRCUIT DO6 | - Short circuit between CVC and external relay  
- Terminals 128 and 129 |
| Display of: SHORTCIRCUIT DO7 | - Short circuit between CVC and external relay  
- Terminals 130 and 131 |
| No communications or faulty communications at PROFIBUS | - Switch on help display function Profibus  
- Check cable  
- Check bus number |
# 12. Technical data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Device (B x H x T)</td>
<td>366 x 281 x 140mm</td>
</tr>
<tr>
<td>• Cutout (B x H)</td>
<td>328 x 242mm</td>
</tr>
</tbody>
</table>

| Weight                        | 5 kg      |

<table>
<thead>
<tr>
<th>Degree of protection</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Standards</td>
<td>DIN EN 50178</td>
</tr>
</tbody>
</table>
| • Protection against foreign solids and water | Front: IP 65 to IEC 529  
                                          Housing: IP 20 to IEC 529 |

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Tested to DIN IEC 68-2-1, DIN IEC 68-2-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• For vertical mounting</td>
<td>±0 to 40°C</td>
</tr>
<tr>
<td>• Mounted at 45°</td>
<td>±0 to 40°C</td>
</tr>
<tr>
<td>• Storage/transport</td>
<td>-20°C to 70°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative humidity</th>
<th>Tested to DIN IEC 68-2-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operation</td>
<td>5 to 95% at 25°C (no condensation)</td>
</tr>
<tr>
<td>• Storage/transport</td>
<td>5 to 95% at 25°C (no condensation)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rated voltage</td>
<td>AC 90 - 240V</td>
</tr>
<tr>
<td>• Current consumption (I\text{min})</td>
<td>0.2 A at 230V, 0.4 A at 110V</td>
</tr>
<tr>
<td>• Current consumption (I\text{max})</td>
<td>0.45 A at 230V, 0.9 A at 110V</td>
</tr>
<tr>
<td>• Power loss min./max.</td>
<td>40 W / 100 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electromagnetic compatibility (EMV)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Limit class f. emitted interference:</td>
<td>Classe B to EN55022 (150kHz to 30MHz)</td>
</tr>
</tbody>
</table>
| • Conducted interference on voltage supply lines: | ±2kV to IEC 1000-4-4 (Burst)  
                                          ±1kV to IEC 1000-4-5 (μs-Puls), line to line  
                                          ±2kV to IEC 1000-4-5 (μs-Puls), line to ground |
| • Immunity to interference on signal lines: | ±2kV to IEC 1000-4-4 (Burst) |
| • Immunity to discharge:            | ±6kV to IEC 1000-4-2 (ESD), kontakt discharge |

<table>
<thead>
<tr>
<th>Profibus DP</th>
<th></th>
</tr>
</thead>
</table>
| • Interface transfer protocol   | PROFIBUS DP to DIN 19245  
                                          DP-Slave |
| • Transfer rate                 | max. 12 Mbit/s |
| • Automatic baudrate search     | Yes       |
| • Bus number                    | 2 to 125 (manuell adjustable) |
12.1. Interference diagram

CVC 600

Scan Settings (1 Range)

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>Receiver Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Stop</td>
</tr>
<tr>
<td>150k</td>
<td>30M</td>
</tr>
</tbody>
</table>

Final Measurement: x QP / + AV

Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

dBuV

16. Feb 01 10:52
12.2. Profibus test certificate

ZERTIFIKAT

Die PROFIBUS Nutzerorganisation e.V. erteilt der

VISCOTHERM AG
Neuhaus, CH-8132 Hinteregg
das Zertifikat Nr.: Z00640
für folgendes Produkt:

Name: CVC
Modell: CVC Steuergerät
Version: Revision_1; SW: 2.0
GSD: CVC_04F1.gsd

Das Zertifikat bestätigt, daß das oben genannte Produkt die Prüfungen auf Konformität für PROFIBUS-DP Slave-Geräte erfolgreich bestanden hat.


Karlsruhe, den 09.07.2001

(Bearbeiter)

Der Vorstand der PROFIBUS Nutzerorganisation:

(E. Küster)  (K.-P. Lindner)
12.3. **Pressure gauge contacts, terminals 72-73, 74-75**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact voltage</td>
<td>380 VAC</td>
</tr>
<tr>
<td>Contact current</td>
<td>10 A</td>
</tr>
<tr>
<td>Contact resistivity</td>
<td>30 mΩ</td>
</tr>
<tr>
<td>Contact material</td>
<td>AgSnO gold-coated</td>
</tr>
<tr>
<td>Mechanical lifetime</td>
<td>$5 \times 10^7$ cycles</td>
</tr>
<tr>
<td>Electrical lifetime</td>
<td>$10^5$ cycles (8 A / 250 VAC)</td>
</tr>
</tbody>
</table>

12.4. **Analog inputs, terminals 1-6, 101-116**

![Analog input diagram]

12.5. **Analog outputs, terminals 21-28**

![Analog output diagram]
12.6. Manufacturer explanation

Erklärung des Herstellers (Einbauerklärung)

im Sinne der EG-Maschinenrichtlinie Anhang II B

Der Hersteller: Viscotherm AG
8132 Hinteregg, Schweiz

erklärt, dass die nachfolgende Maschine (Baugruppe):

Elektronisches Steuergert CVC600

zum Einbau in eine Maschine bestimmt ist, und dass ihre Inbetriebnahme so lange
untersagt ist, bis festgestellt ist, dass die Maschine, in die diese Baugruppe eingebaut
werden den Bestimmungen der EG-Richtlinie entspricht.

EG Richtlinien: Maschinenrichtlinie 98/37/EG
Niederspannungsrichtlinie 73/23/EWG
Elektromagnetische Verträglichkeit 89/336/EWG

Harmonisierende Normen:
EN 50178 Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln
EN 60204 - 1 Maschinensicherheit
EN 50081 - 1, 2 EMV, Störabstrahlung
EN 50082 - 1, 2 EMV, Störfestigkeit
EN 55022 Grenzwerte und Messverfahren
EN 61000 - 4 - 4 EFT, Störfestigkeit auf schnelle Transienten
EN 61000 - 4 - 5 Surge, Störfestigkeit auf Stoffspannungen
EN 61000 - 4 - 2 ESD, Störfestigkeit auf Entladungen

Hinteregg, den 12.03.2003 Marco Metzger, Entwicklung
13. **Accessories, options and spare parts**

13.1. **Viscotherm parts**

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
</table>
| 006014      | Pressure sensor 250 bar  
Pressure sensor 250 bar  
Service information SI-09 |
| 006075      | Speed sensor PNP  
Speed sensor PNP  
Service information SI-21  
Green switching surface |
| 006879      | Speed sensor Namur  
Service information SI-15  
Blue switching surface |
| 004085      | Speed sensor Hall Namur  
Service information SI-56 |
| 008043      | Speed sensor Hall PNP  
Service information SI-50  
Blue switching surface |
| 008065      | Speed sensor NPN  
Service information SI-98  
Red switching surface |
<p>| 000225      | Speed impulse transmitter (tachogenerator) RH-1 |</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Service Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Branch box</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure sensor 250 bar / Ex</td>
<td>SI-17</td>
</tr>
<tr>
<td></td>
<td>Commutation amplifier with power pack</td>
<td>SI-45, SI-51</td>
</tr>
<tr>
<td></td>
<td>Zener barrier</td>
<td>SI-42</td>
</tr>
<tr>
<td></td>
<td>Sensor test apparatus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test apparatus applicable to display and control units</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transducer 400/5 (for full hydraulics only)</td>
<td>SI-31</td>
</tr>
<tr>
<td></td>
<td>Transducer (for full hydraulics only)</td>
<td>SI-30</td>
</tr>
</tbody>
</table>

- Branch box
  - Pressure sensor 250 bar / Ex
    - Service information SI-17
  - Commutation amplifier with power pack
    - Service information SI-45, SI-51
  - Zener barrier
    - Service information SI-42
  - Sensor test apparatus
  - Test apparatus applicable to display and control units
  - Transducer 400/5 (for full hydraulics only)
    - Service information SI-31
  - Transducer (for full hydraulics only)
    - Service information SI-30
<table>
<thead>
<tr>
<th>Sensor Signal Box</th>
<th>012385</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transducer RS232 – RS422</td>
<td>on request</td>
</tr>
</tbody>
</table>
### 13.2. Parts supplied by third-party manufacturers

<table>
<thead>
<tr>
<th>Part Type</th>
<th>Supplier</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profibus connector (180°)</td>
<td>Siemens</td>
<td>6GK1 500-0FC00</td>
</tr>
<tr>
<td>Profibus cable (standard)</td>
<td>Siemens</td>
<td>6XV1830-0EH10</td>
</tr>
<tr>
<td>C7-633DP SPS sub-Assembly</td>
<td>Siemens</td>
<td>6ES7633-2BF02-AE3</td>
</tr>
<tr>
<td>Profibus scanner module for Allen-Bradley SLC 500</td>
<td>SST</td>
<td>SST-PFB-SLC</td>
</tr>
<tr>
<td>Profibus scanner for Allen-Bradley PLC-5</td>
<td>SST</td>
<td>SST-PFB-PLC5</td>
</tr>
<tr>
<td>Profibus module for GE Fanuc Series 90-70</td>
<td>SST</td>
<td>SST-PFB-GE</td>
</tr>
<tr>
<td>Profibus module for Reliance AutoMax</td>
<td>SST</td>
<td>SST-PFB-REL</td>
</tr>
<tr>
<td>Profibus – Ethernet gateway</td>
<td>Hilscher</td>
<td>PKV 40-PB</td>
</tr>
<tr>
<td>Profibus Protokollconverter</td>
<td>Hilscher</td>
<td>PKV 20-PB</td>
</tr>
<tr>
<td>Profibus PC104 Interface</td>
<td>Hilscher</td>
<td>CIF 60-PB</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Profibus PC-ISA Interface</td>
<td>Hilscher</td>
<td>CIF 30-PB</td>
</tr>
</tbody>
</table>
Adresses of third-party manufacturers

Siemens
Siemens
Automatisierungs- und Antriebstechnik (A&D)
91050 Erlangen
Germany

Siemens Energy &Automation
100 Technology Drive
USA-GA 30203 Alpharetta

http://www.ad.siemens.de

SST
SST Headquarter
50 Northland Road
Waterloo, Ontario
Canada N2V 1N3

SST Europe
Gewerbestrasse 60
7515 Bretten Gölishausen
Germany

http://www.sstech.on.ca

Hilscher
Hilscher Gesellschaft für Systemautomation mbH
Rheinstrasse 78
65795 Hattersheim
Deutschland

http://www.hilscher.com