DOC343.53.90514

RTC modules for wastewater treatment

User Manual

08/2015, Edition 1

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Pollution degree	3
Protection class	III
Installation category	I
Degree of protection	IP20
Mounting	DIN rail EN 50022 or panel mount
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage temperature	–25 to +85 °C (–13 to +185 °F)
Relative humidity	95%, non-condensing
Flash memory	CF compact flash card
Interface	RJ 45 (Ethernet), 10/100 Mbit/s
Operating system	Microsoft Windows® CE or Embedded Standard
Power supply	24 V DC or 100–240 V AC with external power supply
Warranty	1 year (EU: 2 years)

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

⚠DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.1.3 Certification

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

2.2 Product overview

NOTICE

The use of a Real-Time Controller (RTC) module does not replace system maintenance. Make sure that all instruments connected to the RTC controller are always in good condition. Regular maintenance is necessary to make sure that the instruments supply correct, reliable measurement values. Refer to the user documentation of each instrument.

RTC modules are general application control units that make some processes better in treatment plants. RTC modules are available as 1-channel, 2-channel or multi-channel systems.

Multi-channel RTC modules are usually operated on industrial PCs (IPC) and all input/output signals are transferred through the sc1000 controller. Refer to the sc1000 documentation. Refer to the documentation supplied with the hardware.

2.3 Product components

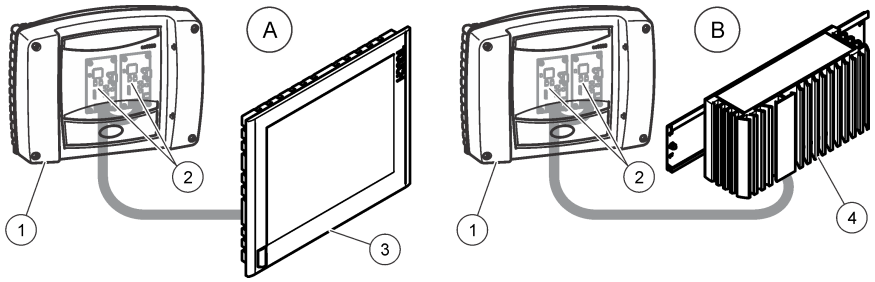
NOTICE

The combination of pre-assembled components supplied by the manufacturer does not show an independently-functioning unit. In accordance with EU guidelines, this combination of pre-assembled components is not supplied with a CE mark, and there is no EU declaration of conformity for the combination. However, the conformity of the combination of components with the guidelines can be proved through technical measurements.

Make sure that all components have been received. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 1 shows the sc1000 controller with an industrial PC. Version A shows the sc1000 installation with a touch panel PC and version B with a DIN rail box PC.

Figure 1 Installation examples version A and version B



1 sc1000 controller	**3** Touch panel PC
2 RTC communication card (2x)	**4** DIN rail box PC

Section 3 Installation

⚠ WARNING

Potential Electrocution Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

⚠ CAUTION

Possible danger to sensor or logger. Always disconnect power to the instrument when making any electrical connections.

3.1 Install the RTC module

Only install RTC DIN rail versions on a DIN rail. Only install an IPC panel mount versions according to the IPC manufacturer specifications that are supplied with the hardware.

Attach the module horizontally. Make sure that the passive aeration element operates correctly. Make sure that there is a minimum of 30 mm (1.2 in.) of space around the module.

To use the RTC module indoors, install the module in a control cabinet. To use the RTC module outdoors, install the module in an enclosure. Refer to Specifications on page 3 for the enclosure specifications.

An sc1000 controller is necessary to operate the RTC module. Refer to the sc1000 controller documentation. It is necessary to use software version V2.30 (or higher) for the sc1000 controller.

Hardware is subject to change without notice. Refer to the sc1000 documentation and other hardware documentation for input/output electrical wiring. Additional information of RTC controllers and setting parameters is available on the manufacturer's website.

This instrument is rated for an altitude of 2000 m (6562 ft) maximum. Use of this instrument at an altitude higher than 2000 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

3.1.1 Supply power to the RTC module

⚠ DANGER

Electrocution hazard. Do not connect AC power directly to a DC powered instrument.

An external deactivation switch is necessary for all installations. Refer to Table 1.

Table 1 Supply voltage of the RTC module

Specification	Description
Voltage	24 V DC (-15%/+20%), 120 W (maximum)
Recommended fuse	C2
With 110–240 V option	240 V, 50–60 Hz, 120 VA (maximum)

3.2 Connect to the process instruments

The measurement signals of the sc sensors, analyzer and other input signals are supplied to the RTC module through the RTC communication card in the sc1000. For information about the power supply of the sc1000 controller and the sc sensors, refer to the applicable documentation for the sc1000 controller and sc sensors.

3.3 Connect to the controller

Attach the supplied SUB-D connector to a two-wire, shielded data cable (signal or bus cable). Refer to the applicable documentation for the data cable connection.

3.4 RTC input and output variables values

All input and output signals are connected to the sc1000 controller or directly to the RTC module. Refer to the RTC module and the sc1000 documentation.

Refer to Table 2 and Table 3 for the RTC101 P-module measurement values.

Refer to Table 4, Table 5, Table 6 and Table 7 for the RTC105 N/DN-module measurement values.

Refer to Table 8 and Table 9 for the RTC113 ST-module and RTC112 SD-module measurement values.

Refer to Table 10 and Table 11 for the RTC103 N-module measurement values.

Refer to Table 12 for the RTC111 SRT-module measurement values.

Table 2 RTC101 P-module (1-channel)

Tag name	Parameter	Unit	Channel	Description
RTC input	PO_4-P	mg/L	1	Phosphate
RTC input	Flow rate	L/s	1	Supply volume flow
MEASUREMENT 1	Q 1	L/s	1	Wastewater flow rate
ACTUAT VAR 2	Pdos 1	L/h	1	Set point precipitant dosing volume
ACTUAT VAR 3	Digi 1	—	1	Digital output for pulsed pump operation (ON/OFF)
ACTUAT VAR 4	Preg 1	L/h	1	Internal calculation variable for precipitant volume
ACTUAT VAR 5	ß' 1	—	1	Only with open loop: ß' otherwise internal calculation variable.
ACTUAT VAR 6	Qras 1	L/s	1	Return sludge volume

Table 3 RTC101 P-module (2-channels)

Tag name	Parameter	Unit	Channel	Description
RTC input	PO_4-P	mg/L	1	Phosphate 1
RTC input	PO_4-P	mg/L	2	Phosphate 2
RTC input	Flow rate	L/s	1	Supply volume flow 1
RTC input	Flow rate	L/s	2	Supply volume flow 2
MEASUREMENT 1	Q 1	L/s	1	Wastewater flow rate channel 1
MEASUREMENT 2	Q 2	L/s	2	Wastewater flow rate channel 2
ACTUAT VAR 3	Pdos 1	L/h	1	Set point precipitant dosing volume
ACTUAT VAR 4	Digi 1	—	1	Digital output for pulsed pump operation (ON/OFF)
ACTUAT VAR 5	Preg 1	L/h	1	Internal calculation variable for precipitant volume
ACTUAT VAR 6	ß' 1	—	1	Only with open loop: ß' otherwise internal calculation variable.
ACTUAT VAR 7	Qras 1	L/s	1	Return sludge volume
ACTUAT VAR 8	Pdos 2	L/h	2	Set point precipitant dosing volume
ACTUAT VAR 9	Digi 2	—	2	Digital output for pulsed pump operation (ON/OFF)
ACTUAT VAR 10	Preg 2	L/h	2	Internal calculation variable for precipitant volume

Table 3 RTC101 P-module (2-channels) (continued)

Tag name	Parameter	Unit	Channel	Description
ACTUAT VAR 11	ß' 2	—	2	Only with open loop: ß' otherwise internal calculation variable.
ACTUAT VAR 12	Qras 2	L/s	2	Return sludge volume

Table 4 RTC105 N/DN-module (1-channel)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N	mg/L	1	Ammonia
RTC input	NO_3-N	mg/L	1	Nitrate
RTC input	Flow rate	L/s	1	Optional: Flow rate to biological treatment
MEASUREMENT 1	Qin 1	%	1	Flow rate as fed to the RTC
ACTUAT VAR 2	B_S 1	Stage	1	Blower stage (ON/OFF)
ACTUAT VAR 3	Nreg 1	—	1	Internal calculation value Nitrogen based

Table 5 RTC105 N/DN-module (2-channels)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N	mg/L	1	Ammonia 1
RTC input	NO_3-N	mg/L	1	Nitrate 1
RTC input	NH_4-N	mg/L	2	Ammonia 2
RTC input	NO_3-N	mg/L	2	Nitrate 2
RTC input	Flow rate	L/s	1	Optional: Flow rate to biological treatment 1
RTC input	Flow rate	L/s	2	Optional: Flow rate to biological treatment 2
MEASUREMENT 1	Qin 1	%	both	Flow rate as fed to the RTC
ACTUAT VAR 2	B_S 1	Stage	1	Blower stage (ON/OFF)
ACTUAT VAR 3	Nreg 1	—	1	Internal calculation value Nitrogen based
ACTUAT VAR 4	B_S 2	Stage	2	Blower stage (ON/OFF)
ACTUAT VAR 5	Nreg 2	—	2	Internal calculation value Nitrogen based

Table 6 RTC105 N/DN-module (1-channel with DO option)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N	mg/L	1	Ammonia
RTC input	NO_3-N	mg/L	1	Nitrate
RTC input	DO	mg/L	1	Oxygen
RTC input	Flow rate	L/s	1	Optional: Flow rate to biological treatment
MEASUREMENT 1	Qin 1	%	1	Flow rate as fed to the RTC
ACTUAT VAR 2	B_S 1	Stage	1	Aeration stage (ON/OFF)
ACTUAT VAR 3	Nreg 1	—	1	Internal calculation value Nitrogen based
ACTUAT VAR 4	Oreg 1	—	1	Internal calculation value oxygen based
ACTUAT VAR 5	A_S 1	%	1	Aeration intensity VFD 1
ACTUAT VAR 6	A_S 2	%	1	Aeration intensity VFD 2
ACTUAT VAR 12	Osetp 1	mg/L	1	O_2 set point

Table 7 RTC105 N/DN-module (2-channels with DO option)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N	mg/L	1	Ammonia 1
RTC input	NO_3-N	mg/L	1	Nitrate 1
RTC input	DO	mg/L	1	Oxygen 1
RTC input	NH_4-N	mg/L	2	Ammonia 2
RTC input	NO_3-N	mg/L	2	Nitrate 2
RTC input	DO	mg/L	2	Oxygen 2
RTC input	Flow rate	L/s	1	Optional: Flow rate to biological treatment 1
RTC input	Flow rate	L/s	2	Optional: Flow rate to biological treatment 2
MEASUREMENT 1	Qin 1	%	1	Flow rate as fed to the RTC
ACTUAT VAR 2	B_S 1	Stage	1	Aeration stage (ON/OFF)
ACTUAT VAR 3	Nreg 1	—	1	Internal calculation value Nitrogen based
ACTUAT VAR 4	Oreg 1	—	1	Internal calculation value oxygen based
ACTUAT VAR 5	A_S 1	%	1	Aeration intensity VFD 1
ACTUAT VAR 6	A_S 2	%	1	Aeration intensity VFD 2
ACTUAT VAR 7	B_S 2	Stage	2	Aeration stage (ON/OFF) B_S 2
ACTUAT VAR 8	Nreg 2	—	2	Internal calculation value Nreg
ACTUAT VAR 9	Oreg 2	—	2	Internal calculation value Oreg
ACTUAT VAR 10	A_S 1	%	2	Aeration intensity VFD 1
ACTUAT VAR 11	A_S 2	%	2	Aeration intensity VFD 2
ACTUAT VAR 12	Osetp 1	mg/L	1	O_2 set point
ACTUAT VAR 13	Osetp 2	mg/L	2	O_2 set point

Table 8 RTC113 ST-module and RTC112 SD-module (1-channel)

Tag name	Parameter	Unit	Channel	Description
RTC input	TSSin 1	g/L	1	TS concentration in inflow
RTC input	TSSeff 1	g/L	1	TS concentration in effluent
RTC input	Feedflow 1	L/s	1	Actual feed flow rate
RTC input	Polyflow 1	L/h	1	Actual polymer flow rate
RTC input	Hopper 1	—	1	Pump (ON/OFF)
MEASUREMENT 1	Qin 1	L/s	1	Actual flow rate to thickening
MEASUREMENT 2	Qavg 1	L/s	1	Averaged flow rate to thickening (as defined in menu)
MEASUREMENT 3	Qdos 1	L/h	1	Quantity of polymer added
MEASUREMENT 4	Tsin 1	g/L	1	TS concentration in inflow (modified by averaging).
MEASUREMENT 5	Tsef 1	g/L	1	TS concentration in effluent (modified by averaging and hopper pump operation).
ACTUAT VAR 6	Pdos 1	L/h	1	Calculated set point for polymer flow
ACTUAT VAR 7	Fac 1	g/kg	1	Calculated polymer quantity (g/kg)
ACTUAT VAR 8	Feed 1	L/s	1	Calculated feed flow rate

Table 9 RTC113 ST-module and RTC112 SD-module (2-channels)

Tag name	Parameter	Unit	Channel	Description
RTC input	TSSin 1	g/L	1	TS concentration in inflow
RTC input	TSSeff 1	g/L	1	TS concentration in effluent
RTC input	Feedflow 1	L/s	1	Actual feed flow rate
RTC input	Polyflow 1	L/h	1	Actual polymer flow rate
RTC input	Hopper 1	—	1	Pump (ON/OFF)
RTC input	TSSin 2	g/L	2	TS concentration in inflow
RTC input	TSSeff 2	g/L	2	TS concentration in effluent
RTC input	Feedflow 2	L/s	2	Actual feed flow rate
RTC input	Polyflow 2	L/h	2	Actual polymer flow rate
RTC input	Hopper 2	—	2	Pump (ON/OFF)
MEASUREMENT 1	Qin 1	L/s	2	Actual flow rate to thickening
MEASUREMENT 2	Qavg 1	L/s	1	Averaged flow rate to thickening (as defined in menu)
MEASUREMENT 3	Qdos 1	L/h	1	Quantity of polymer added
MEASUREMENT 4	Tsin 1	g/L	1	TS concentration in inflow (modified by averaging).
MEASUREMENT 5	Tsef 1	g/L	1	TS concentration in effluent (modified by averaging and hopper pump operation).
MEASUREMENT 6	Qin 2	L/s	2	Actual flow rate to thickening
MEASUREMENT 7	Qavg 2	L/s	2	Averaged flow rate to thickening
MEASUREMENT 8	Qdos 2	L/h	2	Quantity of polymer added
MEASUREMENT 9	Tsin 2	g/L	2	TS concentration in inflow (modified by averaging).
MEASUREMENT 10	Tsef 2	g/L	2	TS concentration in effluent (modified by averaging and hopper pump operation).
ACTUAT VAR 11	Pdos 1	L/h	1	Calculated set point for polymer flow
ACTUAT VAR 12	Fac 1	g/kg	1	Calculated polymer quantity (g/kg)
ACTUAT VAR 13	Feed 1	L/s	1	Calculated feed flow rate
ACTUAT VAR 14	Pdos 2	L/h	2	Calculated set point for polymer flow
ACTUAT VAR 15	Fac 2	g/kg	2	Calculated polymer quantity (g/kg)
ACTUAT VAR 16	Feed 2	L/s	2	Calculated feed flow rate

Table 10 RTC103 N-module (1-channel)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N_in 1	mg/L	1	NH_4-N influent
RTC input	NH_4-N_eff 1	mg/L	1	NH_4-N influent effluent
RTC input	TSS 1	g/L	1	TS concentration
RTC input	DO 1	mg/L	1	Oxygen concentration
RTC input	Inflow 1	L/s	1	Flow rate aeration lane
RTC input	IRC 1	L/s	1	Flow rate internal recirculation
RTC input	RAS 1	L/s	1	Flow rate return sludge

Table 10 RTC103 N-module (1-channel) (continued)

Tag name	Parameter	Unit	Channel	Description
MEASUREMENT 1	—	%	1	Nitrifiers concentration
MEASUREMENT 2	SRT	days	1	Sludge Retention Time
ACTUAT VAR 3	NH4-N	kg/h	1	NH_4-N influent load to nitrify.
ACTUAT VAR 4	NffO 1	mg/L	1	DO necessary calculated from influent load.
ACTUAT VAR 5	Osetp 1	mg/L	1	DO set point
ACTUAT VAR 6	Oreg 1	—	1	Internal calculation value oxygen based
ACTUAT VAR 7	B_S 1	Stage	1	Aeration stage
ACTUAT VAR 8	A_S 1	%	1	Aeration intensity VFD 1
ACTUAT VAR 9	A_S 2	%	1	Aeration intensity VFD 2

Table 11 RTC103 N-module (2-channels)

Tag name	Parameter	Unit	Channel	Description
RTC input	NH_4-N_in 1	mg/L	1	NH_4-N influent
RTC input	NH_4-N_eff 1	mg/L	1	NH_4-N influent effluent
RTC input	TSS 1	g/L	1	TS concentration
RTC input	DO 1	mg/L	1	Oxygen concentration
RTC input	Inflow 1	L/s	1	Flow rate aeration lane
RTC input	IRC 1	L/s	1	Flow rate internal recirculation
RTC input	RAS 1	L/s	1	Flow rate return sludge
RTC input	NH_4-N_in 2	mg/L	2	NH_4-N influent
RTC input	NH_4-N_eff 2	mg/L	2	NH_4-N influent effluent
RTC input	TSS 2	g/L	2	TS concentration
RTC input	DO 2	mg/L	2	Oxygen concentration
RTC input	Inflow 2	L/s	2	Flow rate aeration lane
RTC input	IRC 2	L/s	2	Flow rate internal recirculation
RTC input	RAS 2	L/s	2	Flow rate return sludge
MEASUREMENT 1	—	%	1	Nitrifiers concentration
MEASUREMENT 2	SRT	days	1	Sludge Retention Time
ACTUAT VAR 3	NH4-N	kg/h	1	NH_4-N influent load to nitrify.
ACTUAT VAR 4	NffO 1	mg/L	1	DO necessary calculation from influent load.
ACTUAT VAR 5	Osetp 1	mg/L	1	DO set point
ACTUAT VAR 6	Oreg 1	—	1	Internal calculation value oxygen based
ACTUAT VAR 7	B_S 1	Stage	1	Aeration stage
ACTUAT VAR 8	A_S 1	%	1	Aeration intensity VFD 1
ACTUAT VAR 9	A_S 2	%	1	Aeration intensity VFD 2
ACTUAT VAR 10	NH4-N	kg/h	2	NH_4-N influent load to nitrify.
ACTUAT VAR 11	NffO 2	mg/L	2	DO necessary calculated from influent load.
ACTUAT VAR 12	Osetp 2	mg/L	2	DO set point

Table 11 RTC103 N-module (2-channels) (continued)

Tag name	Parameter	Unit	Channel	Description
ACTUAT VAR 13	Oreg 2	—	2	Internal calculation value oxygen based
ACTUAT VAR 14	B_S 2	Stage	2	Aeration stage
ACTUAT VAR 15	A_S 1	%	2	Aeration intensity VFD 1
ACTUAT VAR 16	A_S 2	%	2	Aeration intensity VFD 2

Table 12 RTC111 SRT-module (1-channel)

Tag name	Parameter	Unit	Channel	Description
RTC input	TSS AE 1	g/L	1	TS concentration aeration basin
RTC input	TSS SAS 1	g/L	1	TS concentration surplus activated sludge
RTC input	TSS eff 1	g/L	1	TS concentration effluent
RTC input	DO1_1	mg/L	1	O_2 concentration aeration zone 1
RTC input	DO1_2	mg/L	1	Optional: O_2 concentration aeration zone 2
RTC input	DO1_3	mg/L	1	Optional: O_2 concentration aeration zone 3
RTC input	DO1_4	mg/L	1	Optional: O_2 concentration aeration zone 4
RTC input	SAS flow 1	mg/L	1	Flow rate surplus activated sludge
RTC input	Flow 1	mg/L	1	Flow rate influent
MEASUREMENT 1	Qeff 1	L/s	1	Effluent flow as supplied to the RTC.
MEASUREMENT 2	Qsas 1	L/s	1	Surplus activated sludge flow
MEASUREMENT 3	Qsasm 1	kg/h	1	Sludge mass flow in surplus start sludge
MEASUREMENT 4	Vol 1	m^3	1	Actually aerated volume
MEASUREMENT 5	Vols 1	m^3	1	Averaged aerated volume during past sludge retention time.
MEASUREMENT 6	TSmL 1	g/L	1	Averaged TS concentration in aeration basins during past sludge retention time.
MEASUREMENT 7	TSs s1	kg	1	Mass of sludge in aeration basins, averaged for past sludge retention time.
MEASUREMENT 8	SRT 1	days	1	Calculated actual aerobic sludge retention time
ACTUAT VAR 9	SRTSP 1	days	1	Set point for aerobic sludge retention time
ACTUAT VAR 10	Qs c1	L/s	1	Theoretical flow set point for surplus start sludge flow
ACTUAT VAR 11	Qs 1	L/s	1	Effective set point for surplus activated sludge flow including all preset limits.
ACTUAT VAR 12	Digi 1	no unit	1	Surplus activated sludge pump ON/OFF signal
ACTUAT VAR 13	msaSP 1	kg/d	1	Set point for sludge mass draws off.
ACTUAT VAR 14	msasd 1	kg/d	1	Surplus activated sludge mass draw off during last 24 hours.
ACTUAT VAR 15	msash 1	kg/h	1	Actual surplus activated sludge mass draw off.
ACTUAT VAR 16	msas 1	kg	1	Surplus activated sludge mass draw off during actual calendar day.

Table 13 RTC111 SRT-module (2-channels)

Tag name	Parameter	Unit	Channel	Description
RTC input	TSS AE 1	g/L	1	TS concentration aeration basin
RTC input	TSS SAS 1	g/L	1	TS concentration surplus activated sludge
RTC input	TSS eff 1	g/L	1	TS concentration effluent
RTC input	DO1_1	mg/L	1	O_2 concentration aeration zone 1
RTC input	DO1_2	mg/L	1	Optional: O_2 concentration aeration zone 2
RTC input	DO1_3	mg/L	1	Optional: O_2 concentration aeration zone 3
RTC input	DO1_4	mg/L	1	Optional: O_2 concentration aeration zone 4
RTC input	SAS flow 1	mg/L	1	Flow rate surplus activated sludge
RTC input	Flow 1	mg/L	1	Flow rate influent
RTC input	TSS AE 2	g/L	2	TS concentration aeration basin
RTC input	TSS SAS 2	g/L	2	TS concentration surplus activated sludge
RTC input	TSS eff 2	g/L	2	TS concentration effluent
RTC input	DO2_1	mg/L	2	O_2 concentration aeration zone 1
RTC input	DO2_2	mg/L	2	Optional: O_2 concentration aeration zone 2
RTC input	DO2_3	mg/L	2	Optional: O_2 concentration aeration zone 3
RTC input	DO2_4	mg/L	2	Optional: O_2 concentration aeration zone 4
RTC input	SAS flow 2	mg/L	2	Flow rate surplus activated sludge
RTC input	Flow 2	mg/L	2	Flow rate influent
MEASUREMENT 1	Qeff 1	L/s	1	Effluent flow as supplied to the RTC.
MEASUREMENT 2	Qsas 1	L/s	1	Surplus activated sludge flow
MEASUREMENT 3	SRT 1	days	1	Calculated actual aerobic sludge retention time
MEASUREMENT 4	Qeff 2	L/s	2	Effluent flow as supplied to the RTC.
MEASUREMENT 5	Qsas 2	L/s	2	Surplus activated sludge flow
MEASUREMENT 6	SRT 2	days	2	Calculated actual aerobic sludge retention time
ACTUAT VAR 7	SRTSP 1	days	1	Set point for aerobic sludge retention time
ACTUAT VAR 8	Qs 1	L/s	1	Effective set point for surplus activated sludge flow including all preset limits.
ACTUAT VAR 9	Digi 1	no unit	1	Surplus activated sludge pump ON/OFF signal
ACTUAT VAR 10	msaSP 1	kg/d	1	Set point for sludge mass draws off.
ACTUAT VAR 11	msas 1	kg	1	Surplus activated sludge mass draw off during actual calendar day.
ACTUAT VAR 12	SRTSP 2	days	2	Set point for aerobic sludge retention time
ACTUAT VAR 13	Qs 2	L/s	2	Effective set point for surplus activated sludge flow including all preset limits.
ACTUAT VAR 14	Digi 2	no unit	2	Surplus activated sludge pump ON/OFF signal
ACTUAT VAR 15	msaSP 2	kg/d	2	Set point for sludge mass draws off.
ACTUAT VAR 16	msas 2	kg	2	Surplus activated sludge mass draw off during actual calendar day.

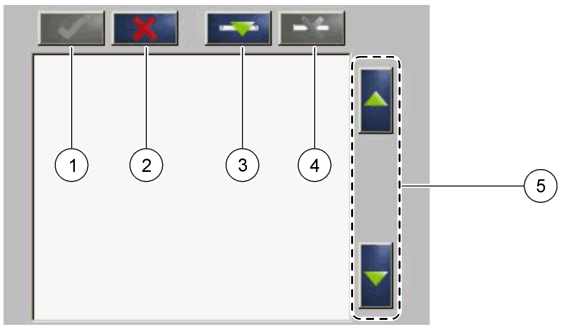
Section 4 Startup

4.1 User interface and navigation

4.1.1 Keypad description

Refer to Figure 2 for the keypad description and navigation information.

Figure 2 Keypad description



1 Enter: Saves the setting and exits the current screen to the CONFIGURE menu	**4** Delete: Removes a sensor from the selection
2 Cancel: Exits the current screen to the CONFIGURE menu without saving the setting	**5** UP and DOWN arrows: Moves the sensors up or down the list
3 Add: Adds a new sensor to the selection	

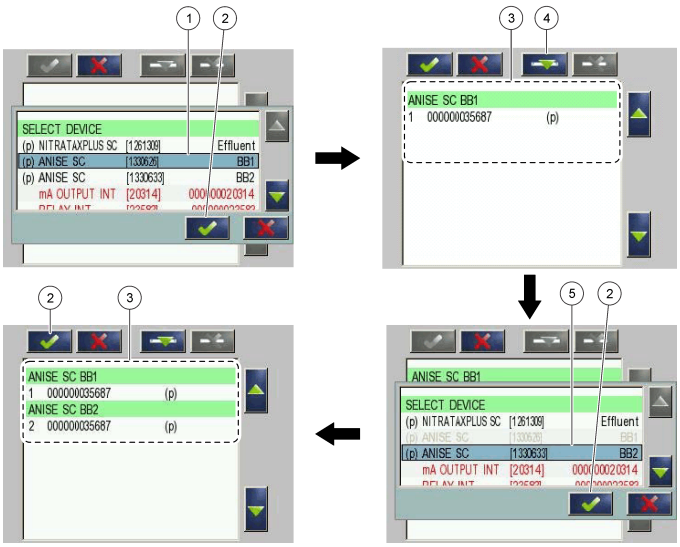
4.2 Add a sensor

Note: *Make sure that an RTC communication card is installed in the sc1000 sensor module.*

1. Connect the controller. Refer to the controller documentation.
2. Select MAIN MENU>RTC MODULES/PROGNOSYS>RTC MODULES>RTC>CONFIGURE>SELECT SENSOR.
3. Push **Add**. Refer to Figure 3.
   A list with all network connections shows.
4. Select the applicable sensor for the RTC module and push **Enter**. The sensor is shown in the sensor list.
   Note: *The sensor names in black are available for an RTC module. The sensor names in red are not available for an RTC module. A sensor name identified with a "(p)" is available for PROGNOSYS.*

   Note: *The mA input cards and the PROFIBUS card (item no. YAB103) can supply RTC input signals.*
5. Push **Add** to add more sensors or input cards from the list. Selected sensors show in gray. Refer to Figure 4 on page 18 to set the sensor sequence. Refer to Figure 5 on page 19 to remove a sensor.
6. Push **Enter** to accept the list.

Figure 3 Add sensors

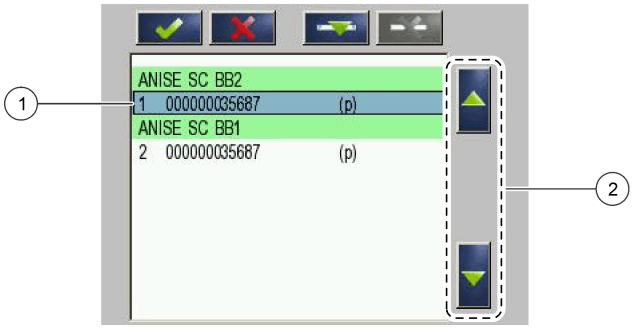


1 Select sensor	**4** Add
2 Accept	**5** Select additional sensor or input card
3 Sensor list	

4.2.1 Sort the sensors (RTC modules only)

The sensor sequence is programmed in the RTC module for the measurement values. To sort the sensors in the order specified for the RTC module, move the selected sensor with the UP and DOWN arrows. Refer to Figure 4.

Figure 4 Sort the sensors

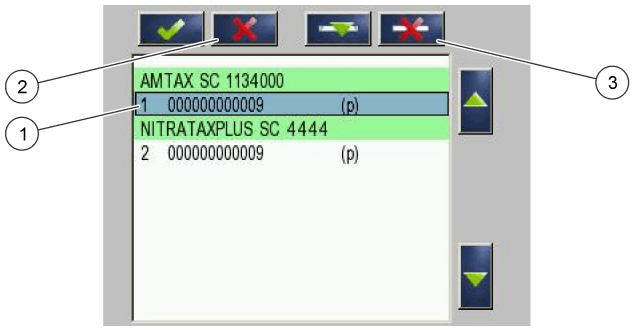


1 Select sensor	**2** UP and DOWN arrows

4.2.2 Delete a sensor from the list

To delete a selected sensor from the list, push **Delete**. Refer to Figure 5.

Figure 5 Delete a sensor



1 Select sensor	**3** Delete the sensor
2 Go back without changes	

Section 5 Configuration

Before the instrument is used with an sc controller become familiar with the configuration mode of the sc controller. Refer to the sc controller documentation to learn how to use and navigate the menu functions. Each RTC module shows the same menu items except for the settings in the CONFIGURE menu. Use the steps that follow to configure the RTC module.

1. Go to the MAIN MENU.
2. Select RTC MODULES / PROGNOSYS>RTC MODULE>RTC>CONFIGURE.
3. Select the RTC-module to use.
   - Refer to RTC101 P-module on page 21 for the configuration of the RTC101 P-module.
   - Refer to RTC105 N/DN-module on page 26 for the configuration of the RTC105 N/DN-module.
   - Refer to RTC112 SD-module and RTC113 ST-module on page 33 for the configuration of the RTC112 SD-module and RTC113 ST-module.
   - Refer to RTC103 N-module on page 38 for the configuration of the RTC103 N-module.
   - Refer to RTC111 SRT-module on page 43 for the configuration of the RTC111 SRT-module.

5.1 RTC101 P-module

5.1.1 Open-loop and closed-loop control programs

Open-loop—For the control of precipitant dosing, the measuring point for phosphate concentration is upstream of the precipitant dosing point.

Closed-loop—For the control of the precipitant dosing, the measuring point for the phosphate concentration is downstream of the precipitant dosing point.

The measuring point for the flow rate is in the influent of the wastewater treatment plant. At the measuring point, the actual flow rate (influent quantity and recirculation) is found through more entries in the RTC module.

If the measured values for the flow rate quantity and/or phosphate concentration are temporarily not available, the system automatically refers to a saved dosing profile.

5.1.2 Configure the RTC101 P-module

The module is available in an open-loop version and a closed-loop version, each version is available as a 1-channel or a 2-channel version. A 2-channel version is also available with first channel as closed-loop and second channel as open-loop.
The 2-channel version can control two phosphate precipitants independently. All of the key parameters are shown two times and are identified as channel 1 and channel 2.

1. Go to SELECT SENSOR and select the sensor installed for the open-loop or closed-loop control. Refer to Add a sensor on page 17.
2. If an open-loop control is installed, set the PRECIP.TYP precipitation, simultaneous precipitation or post-precipitation.
3. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.
4. Select SETPOINT PO4-P to set the ortho-phosphate value in the effluent stream (in mg/L). Refer to Phosphate control method on page 23.

5. For an open-loop control version, select an option. Go to step 6 for a closed-loop control version configuration.

Option	Description
CORRECTION DOSAGE	Sets the percentage correction of precipitant dosing. Refer to The effect of the chemical sludge on page 23.
BIO-P	Sets the percentage of the biological phosphate elimination after the influent. Refer to Calculate the biological phosphate elimination on page 24.

6. For a closed-loop control version, select an option.

Option	Description
FACT P CONTROL	Sets the proportional gain factor of the precipitant dosing control. Refer to PID closed-loop control method on page 24.
INTEGRALTIME	Sets the integral time of closed-loop control (in minutes). Refer to PID closed-loop control method on page 24.
DERIVATIVE TIME	Sets the derivative time of closed-loop control (in minutes). Refer to PID closed-loop control method on page 24.

7. Select MIN DOS RATE to set the minimum flow rate of the dosing pump (in L/h).
8. Select PROFILE, which is only active during a measurement signal failure. Select an option.

Option	Description
DOSAGE CHANNEL 1	Uses as a default strategy for polymer dosing when the phosphate measurement and/or the flow rate signal is not available (in L/h).
DOSAGE CHANNEL 2	Uses as a default strategy for polymer dosing when the phosphate measurement and/or the flow rate signal is not available (in L/h).
WEEK PROFILE	Sets the percentage daily averages of the phosphate load (volume x concentration).

9. Select IN-OUTPUTS>DOSING PUMP. For a 2-channel version, select CHANNEL 1 or CHANNEL 2. Select an option.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN PUMP RANGE	Specifies the minimum of the flow rate range (in L/h).
MAX PUMP RANGE	Specifies the maximum of the flow rate range (in L/h).
0/4...20mA	Sets the transfer range based on the pump input.
CONTROL CYCLE	Includes the ON and OFF time of the pump (in seconds). Refer to Set the pump runtime on page 25.
MIN RUNTIME	Sets the minimum ON time of the pump (in seconds). Refer to Set the pump runtime on page 25.

10. Select IN-OUTPUTS>FLOW RATE. For a 2-channel version, select CHANNEL 1 or CHANNEL 2. Select an option.

    Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN Q-INFLUENT	Sets the minimum flow rate in the inlet based on the measurement signal (in L/h).

Option	Description
MAX Q-INFLUENT	Sets the maximum flow rate in the inlet based on the measurement signal (in L/h).
0/4...20mA	Sets the transfer range of the 0/4 to 20 mA current loop, as set in the connected flow measuring instrument.
DISTR. CHAN1/CHAN2	Sets the percentage distribution ratio to channel 1, if only one flow rate signal is available and connected to the analogue input 1.
MIN RET SLUDGE	Sets the minimum flow rate of the return-activated sludge pump(s) (in L/h). Refer to Calculate the return sludge quantity on page 25.
MAX RET SLUDGE	Sets the maximum flow rate of the return-activated sludge pump(s) (in L/h). Refer to Calculate the return sludge quantity on page 25.
Q RET RATIO	Sets the percentage of the return-activated sludge volume based on the measured flow rate. Refer to Calculate the return sludge quantity on page 25.
Q INFL SMOOTH	Decreases the fluctuation of the influent signal. Refer to Calculate the return sludge quantity on page 25.

11. Select PRECIPITANT. For a 2-channel version, select CHANNEL 1 or CHANNEL 2. Select an option.

Option	Description
METAL CONTENT	Sets the metal concentration in the precipitant (in g/L). Refer to Precipitant type on page 25.
ATOMIC WEIGHT	Sets the relative atomic weight of the active precipitant material (in g/mol). Refer to Precipitant type on page 25.

12. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

13. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
14. SET DEFAULTS restores the factory settings.

    Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

5.1.3 Phosphate control method

Use phosphate control to reduce the total phosphate in the effluent stream at a wastewater treatment plant. The PO_4-P objective value specifies only the ortho-phosphate value in the precipitation reactor. Thus, the PO_4-P objective value must be lower than the total phosphate value to be kept in the effluent.

Note: *If CLOSED-LOOP is set in the controller, the set point is used immediately. If OPEN-LOOP is set in the controller, the applicable PO_4-P effluent concentration of the reactor is necessary.*

5.1.4 The effect of the chemical sludge

To save precipitant for the phosphorus elimination, recycle the existing chemical sludge. If more precipitant is dosed (as necessary), then some of the metal content for the metal phosphate formation is not used. The recycled chemical sludge that is not used will form with the dissolved phosphate to make new metal phosphate formations. A new adsorption of phosphate from already-formed precipitates is possible. The existing chemical sludge gives a store for the precipitation of P-influent peaks or for a temporarily failure of the dosing devices.

The closed-loop control automatically recycles the chemical sludge and saves precipitant. For the open-loop control, set the CORR FACTOR to recycle the chemical sludge. A negative input decreases the precipitant dosing:

Example: A correction value of –50% decreases the precipitant dosing by half.

If the phosphate precipitation decreases, set a positive correction value:

Example: A correction value of +100% increases the precipitant dosing by two.

5.1.5 Calculate the biological phosphate elimination

1. Use the BIO-P parameter for the biological phosphate elimination.
2. Set the percentage of influent phosphate that is biologically included into the sludge on an empirical basis.
3. Make sure that the measurement results of ortho-phosphate and total phosphate have different meanings.
4. Add the unavoidable biological phosphate elimination for total phosphate measurements and set the BIO-P at 1% of the BOD_5.
5. Calculate the increased biological phosphate elimination based on empirical values.

5.1.6 PID closed-loop control method

Proportional, Integral and Differential (PID) closed-loop makes the precipitant dosing more accurate. The proportional precipitant dosing quantity calculated by the RTC module is increased or decreased by the proportional gain factor (FACT P CONTROL) of the closed loop control.

If the precipitant operates at the measuring point, one of the measurements that follow will show that:

- The dosage is too low.
- The dosage is sufficient.
- The dosage is too high.

The proportional gain factor specifies that the necessary precipitant dosage is based on the exceedance of the objective value. Large gains result in large changes to the dosing and therefore a high closed-loop control speed. The closed-loop control oscillations also increase in line with the gain.

The DERIVATIVE TIME lets the RTC module react not only to the absolute objective value deviations, but also to the speed with which the phosphate content increases or decreases.

Example: For a derivative time of 1 minute, the closed-loop control calculates the precipitant dosage based on the phosphate concentration that is actually received in 1 minute (if the current measured value change stays the same).

The INTEGRALTIME operates with the temporal integration of the control deviation (PO_4-P set point to PO_4-P actual value). The integral time is correct when the integral proportion has the same effect as the P proportion. A short integral time can cause an overshoot or strong oscillations of the PO_4-P concentration. An increase in the integral time decreases the oscillation. To set the integral time proportion of the closed-loop control to off, enter INTEGRALTIME = 0.

Setting tips: A DERIVATIVE TIME >0 minutes has an important effect on the metered precipitant quantity. Use this setting only in unusual cases (e.g., plants with rapid escalations in PO_4-P concentrations).

To make sure that the metered precipitant quantity increases/decreases more quickly, the FACT P CONTROL must be increased or the INTEGRALTIME decreased. Make sure that the metered precipitant quantity changes more slowly, the FACT P CONTROL must be decreased or the INTEGRALTIME increased.

5.1.7 Set the pump runtime

The control cycle time (CONTROL CYCLE) has an effect on the on/off duration in pulse/pause mode. For example, with a cycle time of 100 seconds and a dosing control value of 60%, the dosing pump is periodically set to on for 60 seconds and set to off for 40 seconds. Short cycle times increase the change frequency.

Set the MIN RUNTIME to protect the dosing pump. The pump is not started for less than this time span. The time must be a fraction of the control cycle time.

5.1.8 Calculate the return sludge quantity

Get the return sludge quantity into account to record the entire flow at the measuring point. For this function, set the minimum and maximum flow rate of the return-activated sludge pump(s) plus the ratio of return-activated sludge transport relative to the measured flow rate.

Calculate the flow rate for simultaneous precipitation with a measuring point in the activated sludge tank as follows:

$Q_{total} = Q_{to} + QRSL$

Where: $QRLS = QRS_{ratio} \times Q_{to}$

Within the limits of $Q\ RS_{minimum}$ and $Q\ RS_{maximum}$

$Q\ RS_{minimum}$ and $Q\ RS_{maximum}$ give the limits within the calculated return-activated sludge volume is changed based on $Q\ RS_{ratio}$.

Note: *If the measuring location is at a measuring point that is not influenced by the return-activated sludge volume, set the variables MIN RET SLUDGE, MAX RET SLUDGE and Q RET RATIO to 0.*

1. Set the minimum flow rate of the return sludge pump(s) (MIN RET SLUDGE) (in L/h). If the return sludge flow rate is constant, set the relevant value.
2. Set the maximum flow rate of the return sludge pump(s) (MAX RET SLUDGE) (in L/h). If a constant return-activated sludge volume is pumped, set MAX RET SLUDGE=0.
3. If the return-activated sludge volume is proportional to the flow rate (Q), Q RET RATIO specifies the percentage ratio. If the same return-activated sludge volume is pumped continuously, set MIN RET SLUDGE to this volume and set the Q RET RATIO=0.

The flow rate signal, which is integrated into the RTC module via the 0/4 to 20 mA current loop, can change a lot (e.g., caused by pumping stations). Use Q INFL SMOOTH to decrease the changes and a marginally fluctuating objective value is issued.

Q INFL SMOOTH is between 1 and 99.

- Q INFL SMOOTH = 1. The signal for the influent signal is not influenced.
- Q INFL SMOOTH = 2. The fluctuation of the influent signal is decreased over 3 minutes.
- Q INFL SMOOTH = 3. The fluctuation of the influent signal is decreased over 5 minutes.
- Q INFL SMOOTH = 5. The fluctuation of the influent signal is decreased over 12 minutes.
- Q INFL SMOOTH = 10. The fluctuation of the influent signal is decreased over 25 minutes.

Example: With the setting Q INFLUENT SMOOTH = 2, it gets 3 minutes for the value to have 95% of the final value (after a sudden change of the influent rate).

5.1.9 Precipitant type

Set the effective metal content of the precipitant in g/L and the relative atomic weight of the metal in g/mol.

The manufacturer gives the metal content (active component) as one of the following units.

- **g/kg**—Multiply the value by the density δ of the product to get the metal content in g/L.
- **%**—Multiply the value by 10 to get the concentration in g/kg. Multiply this value by the density δ of the product to get the metal content in g/L.
- **mol/L**—Enter this value instead of the concentration in g/L. Enter ATOMIC WEIGHT = 1.

The type of the precipitant is caused by the atomic weight.

- Atomic weight of iron: 55.8 g/mol
- Atomic weight of aluminum: 26.9 g/mol

Composite products: For products that contain both aluminum and iron, the molar metal concentration is calculated from the sum of the molar concentrations of iron and aluminum. The product of the molar concentration (mol/kg) and the density of the product (kg/L) is the molar metal concentration in mol/L. Enter this value for the metal content, enter ATOMIC WEIGHT = 1. Refer to Table 14.

Table 14 Calculate the atomic weight

Molar aluminum concentration (8%):	80 g/kg / 26.9 g/mol = 2.97 mol/kg
Molar iron concentration (12%):	120 g/kg / 55.8 g/mol = 2.15 mol/kg
Add the molar metal concentrations for the compound of iron and aluminum:	2.97 mol/kg + 2.15 mol/kg = 5.12 mol/kg
Multiply the result with the product density:	1.43 kg/L x 5.12 mol/kg = 7.32 mol/L

5.2 RTC105 N/DN-module

On the RTC105 N/DN-Module, the current NH_4-N (ammonium nitrogen) and NO_3-N (nitrate nitrogen) concentrations set the times for nitrification and denitrification. The controller calculates absolute measured values as well as the increase or decrease rate of the measurements.

If the measured values for NH_4-N and NO_3-N are applicable in the activated sludge tank, the controller is one of the following controller types.

- Combination controller for NH_4-N and NO_3-N
- NH_4-N controller
- NO_3-N controller

If all measurements are temporarily not available, the operation is guaranteed too. A time frame with adjustable minimum and maximum nitrification and denitrification times is given. This time frame has fixed limits that are not decreased or increased for the RTC module. The time frame has priority about all other settings.

The proportional-differential controllers (PD controllers) examine the absolute deviation of the measured values from their selectable objective values.

After the nitrification phase is complete, the NO_3-N concentration increases and the NH_4-N concentration decreases from their objective values more than a specific amount.

The time frame is always in effect, thus the nitrification is:

- Complete, if the maximum nitrification time (NITRI MAX) has expired (Exception: CNP OVERRIDES MAX NITRI. = YES).
- Not complete until the minimum nitrification time (NITRI MIN) has occurred.

After the denitrification phase is complete, the NH_4-N concentration increases and the NO_3-N concentration decreases from their objective values more than a specific amount.

The time frame is always in effect, thus the denitrification is:

- Complete, if the maximum denitrification time (DENITRI MAX) has expired.
- Not complete until the minimum denitrification time (DENITRI MIN) has occurred.

Controller operation with low nitrogen content

If both the NO_3-N and the NH_4-N concentrations are very low, there are no selection criteria for the nitrification/denitrification phase. To save energy, the aeration is set to off until the minimum nitrification time is completed. Set a minimum limit of the NH_4-N concentration, below the aeration is set to off (NH4 MIN MIN).

Time delay control (2-channel version)

In a 2-channel version the time frame operates with a time delay for aerating basin 1 and basin 2. At the same time in one basin is the nitrification phase and in the other basin the denitrification phase. This decreases load peaks in the power consumption.

Note: *To use the time delay control the time frames for the nitrification/denitrification must be the same.*

5.2.1 RTC105 N/DN-module control programs

The four programs in Table 15 calculate the time intervals for the nitrification and denitrification supply an optimal adaptation to the local conditions and to the available measurement signals. If a measurement signal is temporarily not available, the program automatically refers to the respective measurement still available (NH_4-N or NO_3-N). If both measurement signals are temporarily not available, the program automatically refers to the fixed time frame. If the measurements are available again, the program automatically refers to the selected program. The change between programs occurs with a delay of 5 minutes.

Table 15 RTC105 N/DN-module control programs

TIME CONTROL	Fixed time frame
NH4-N	Control based on the NH_4-N concentration
NO3-N	Control based on the NO_3-N concentration
NH4-N and NO3-N	Control based on the NH_4-N and NO_3-N concentration

5.2.2 RTC105 N/DN-module versions

The module is available in a N/DN control version (with or without SBR option) and an O_2 stages control version (with and without VFD option). Each version is available as a 1-channel or a 2-channel version.
The 2-channel version can control two activated sludge tanks or two SBR reactors at the same time. All of the key parameters are shown two times and are identified as channel 1 and channel 2.

5.2.3 Configure the N/DN control version

For control of SBR plants, the controller is notified of sedimentation and drain process by a binary input signal. This stops the control and, in a final measure, the controller sets to off the aeration. A change of the binary input signals to the RTC module stops the drain process. The RTC module starts a nitrification or denitrification phase with selectable duration as given in the pre-selection.

1. Go to SELECT SENSOR and select the sensor installed for the closed-loop control. Refer to Add a sensor on page 17.
2. Select N/DN-CONTROL. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.
3. Select TARGET VALUES to show the installed version. Refer to Set the target values on page 31.

4. Select TIME FRAME and set the options in minutes. Refer to Set the time frames on page 31.

Option	Description
NITRI MIN	Sets a minimum aeration time.
NITRI MAX	Sets a maximum aeration time.
DENITRI MIN	Sets a minimum non-aerated time.
DENITRI MAX	Sets a maximum non-aerated time.
NITRI SUBST.	Sets the nitrification time in the default mode.
DENITRI SUBST.	Sets the denitrification time in the default mode.
START N/DN?	Selects the phase to start the treatment process. (Only applies to SBR option.) • N-PHASE = Nitrification phase • DN-PHASE = Denitrification phase
TIME INIPHASE	Sets the duration for the first treatment phase (in % based on the MAX time). (Only applies to SBR option.)

5. Select CTRL PARAMETER and select an option.

Option	Description
P GAIN NH4+NO3	Sets the reaction strength to the ammonium and nitrate contents, if both measurements are available. Sets the length of the entire cycle time (nitrification and denitrification) (in 1/mg/L). Refer to Set the gain factors on page 31.
DERIV TIME NH4	Closed-loop controller finds the ammonium value that is possible after this derivative time (in minutes). Refer to Set the derivative time on page 32.
DERIV TIME NO3	Closed-loop controller finds the nitrate value that is possible after this derivative time (in minutes). Refer to Set the derivative time on page 32.
P GAIN NH4	Sets the reaction strength to the ammonium content. Sets the length of the aerated phase (applies if only ammonium measurement is available) (in 1/mg/L). Refer to Set the gain factors on page 31.
P GAIN NO3	Sets the reaction strength to the nitrate content. Sets the length of the non-aerated phase (applies if only nitrate measurement is available) (in 1/mg/L). Refer to Set the gain factors on page 31.
NH4-N MIN MIN	Stops nitrification if the NH_4-N concentration is lower than the selected value (in mg/L). Refer to Criteria to stop nitrification on page 32.
C/N/P-MAX MAX	Sets the selected parameter threshold to stop denitrification/extent nitrification (in mg/L). Refer to Criteria to stop denitrification/extend nitrification on page 32.
CNP OVERRIDES NIT. MAX	Extends the nitrification period if the parameter is more than the threshold (NO/YES).
SETPOINT DO MIN	Sets the minimum load dependent DO concentration for nitrification (only available for standardized combined RTC) (in mg/L). Refer to Load dependent DO concentration during nitrification on page 32.
SETPOINT DO MAX	Sets the maximum load dependent DO concentration for nitrification (only available for standardized combined RTC) (in mg/L). Refer to Load dependent DO concentration during nitrification on page 32.

6. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

7. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
8. SET DEFAULTS restores the factory settings.
   Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

5.2.4 Configure the Oxygen stages control version

The optional oxygen control adapts the aeration power to the necessary oxygen concentration. The oxygen control has up to six aeration stages per channel. The aeration stages operate with minimum-maximum limit controllers. The first two aeration stages are available as analog outputs to control variable frequency drives.

1. Go to SELECT SENSOR and select the sensor installed for the closed-loop control. Refer to Add a sensor on page 17.
2. Select O2 CONTROL and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

Option	Description
MAX O2	Sets the maximum O_2 concentration (in mg/L) to change to a lower aeration stage. (Only applies to oxygen stages control options.) Refer to Set the aeration control with stages on page 32.
MIN O2	Sets the minimum O_2 concentration (in mg/L) to change to a higher aeration stage. (Only applies to oxygen stages control options.) Refer to Set the aeration control with stages on page 32.
SETPOINT DO	Sets the DO concentration set point during the nitrification (in mg/L). (Only applies to VFD option.) Refer to Set the aeration control with VFD control (and stages) on page 32.
P GAIN DO	Sets the GAIN for the PD controller (in 1/mg/L). (Only applies to VFD option.) Refer to Set the aeration control with VFD control (and stages) on page 32.
DERIVATIV.TIME	Sets the derivative time to the DO controller (in minutes). Refer to Set the aeration control with VFD control (and stages) on page 32.
INT PART	Sets the integral part for the DO control. (Only applies to VFD option.)
DAMPING	Decreases the influence the change frequency between the aeration stages. For a lower change frequency between aeration stages set damping to more than 10 minutes. Refer to Influence the aeration control with damping on page 33.
BLOCKING TIME FORW.	Sets the minimum running time in an aeration stage before a change in same direction is possible (in minutes) (use again a higher aeration stage or use again a lower stage). Refer to Influence the aeration control with blocking times on page 33.
BLOCKING TIME BACK	Sets the minimum running time in an aeration stage before a change in opposite direction is possible (in minutes) (use a higher aeration stage after a lower stage was used or use a lower aeration stage after a higher stage was used). Refer to Influence the aeration control with blocking times on page 33.

Option	Description
START STAGE MIN	Sets the minimum aeration stage and intensity at the beginning of nitrification. Refer to Set the start stage parameters on page 33. For a fixed frequency and a second VFD blower a value of 1,4 causes in aeration stage 2 for the digital output (both blower running) and the VFD blower running with 40% intensity. (Only applies to VFD option.)
START STAGE DURATION	Sets the maximum duration of the fixed starting aeration stage (in minutes). The DO controller stops during this time.
START STAGE STOP	After the DO concentration has had the percentage value of the DO set point, the fixed start aeration stage is stopped and the DO controller is started.
START STAGE MEMORY	Examines the aeration stage and intensity of DO controller at the time followed the start time. The DO controller will use this value (in minutes) as start value for the next nitrification phase (if it is higher than the start aeration stage).
SUBST AERATION	Sets the aeration stage and intensity if the DO measurement is temporarily not available.

3. Select MIXING and select an option. Refer to Select the mixing function on page 33.

Option	Description
MIXING PAUSE	Sets the time period without mixing (in minutes).
MIXING TIME	Sets the duration of mixing (in seconds). ***Note:*** *Use only aeration stage 1 for mixing.*
MIXING INTENSITY	Sets the intensity of mixing (10 to 100%) in aeration stage 1. (Only applies to VFD option.)

4. Select AERATORS and select an option.

Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
0/4...20mA	Selects the analog output. (Only applies to VFD option.)
VFD I MIN 1	Sets the limit for the analog output 1 to the value of minimum frequency for blower (in %). (Only applies to VFD option and if VFD is configured 0/4 mA = 0Hz .)
VFD I MIN 2	Sets the limit for a second analog output (in %).
NO. OF STAGES	Shows the maximum number of controller aeration stages.
IN NITRI ALWAYS ON	Sets the last aerator to off during nitrification if the DO concentration is too high. (NO/YES)
P MIN AERATOR 1	Sets a percentage aeration intensity at minimum frequency for aerator 1. (Only applies to VFD option.)
P MIN AERATOR 2	Sets a percentage aeration intensity at minimum frequency for aerator 2. (Only applies to VFD option.)
P MAX AER2/AER1	Sets the relation of maximum aeration intensities between the two VFD aerators. If the blowers have equal capacities, the value is 1 (1.5 to 4.0). Refer to Set the aerators parameters on page 33.

5. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

6. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
7. SET DEFAULTS restores the factory settings.
   Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

5.2.5 Set the target values

The module keeps the NH_4-N and the NO_3-N concentration in the activated sludge tank. Selected target values for both parameters are set with the NH_4-N or NO_3-N parameters. (Default NH_4-N = 2.5 mg/L, NO_3-N = 2.5 mg/L)

5.2.6 Set the valuation ratio

Set the valuation ratio NH4/NO3 WEIGHT to calculate the controller result with the combination of the NH_4-N concentration and the NO_3-N concentration. A ratio more than 1 causes a stronger influence on the NH_4-N concentration. A ratio less than 1 causes a stronger influence on the NO_3-N concentration. Only change the valuation ratio if an increase one of the two parameters by a specific value is necessary. Make sure that a change in the valuation ratio can cause a decrease of the aerated/unaerated phases within the set time frame. (Default NH4/NO3 WEIGHT = 1.0)

5.2.7 Set the time frames

The sum of the maximum times for nitrification and denitrification must be approximately 1.25 times of the cycle time.

1 cycle = 1 unaerated phase + 1 aerated phase

1. Set the necessary cycle time (90 to 360 minutes).
2. Control the maximum times NITRI MAX or DENITRI MAX if the NH_4-N (NO_3-N) concentration is too high and the NO_3-N (NH_4-N) concentration is too low. Increase (or decrease) the maximum time if the nitrification or the denitrification is limited by the maximum time.
3. Make sure that the values for NITRI MIN and DENITRI MIN supply a cyclical process under all operating conditions. Set the values as low as possible, and if possible, without influence on the control.
4. Set for NITRI SUBST. and DENITRI SUBSTIT. applicable times to supply a correct nitrification/denitrification phase if the NH_4-N and NO_3-N measurements are not available.

(Default NITRI MAX = 90 min., NITRI MIN = 30 min., DENITRI MAX = 90 min., DENITRI MIN = 30 min., NITRI SUBST. = 60 min., DENITRI SUBSTIT = 60 min.)

5.2.8 Set the gain factors

In all versions of the RTC105 N/DN-module, the gains P GAIN NH4+NO3, P GAIN NH4 and P GAIN NO3 cause the cycle time. Set the gains first to the same level so that the applicable cycle length (nitrification + denitrification) is set in the middle. If the control goes too often in the maximum times, the P GAIN are too small. If the control goes too often in the minimum times or the cycle times are too short, the P GAIN are too big.

Make steps by ±0.1 to change the P GAIN. Adapt the time frame, if no successful operation is found. In general, all gains P GAIN are set to the same values.

- Use P GAIN NH4+NO3 if both measurements (NH_4-N and NO_3-N) are available.
- Use P GAIN NH4 if only the NH_4-N measurement supplies values.

- Use P GAIN NO3 if only the NO_3-N measurement supplies values.

The objective value multiplied by the gain factor P GAIN must always be more than 1.0. For P GAIN NH4+NO3 use the average value of the objective values of NH_4-N and NO_3-N. (Default P GAIN NH4+NO3 = 1.0, P GAIN NH4 = 1.0, P GAIN NO3 = 1.0)

5.2.9 Set the derivative time

The derivative times DERIV TIME NH4 and DERIV TIME NO3 calculate the change rates of the applicable parameters.

1. Use DERIV TIME NO3 only if larger quantities of NO_3-N are in the inlet.
2. Use DERIV TIME NH4 if NH_4-N peaks in the inlet on time by increasing the nitrification times.
3. Make steps by 1.0 minute to increase the derivative time.
4. Set an observation time frame after every change to examine how strongly the cycle time increases and the NO_3-N concentration increases.

(Default DERIV TIME NH4 = 0 min., DERIV TIME NO3 = 0 min.)

5.2.10 Criteria to stop nitrification

If the NH_4-N concentration is less than a certain NH_4-N limit (NH4 MIN MIN) the nitrification stopped independent from the NO_3-N concentration and Nreg. to save energy.

5.2.11 Criteria to stop denitrification/extend nitrification

If a parameter increases an adjustable threshold (C/N//P MAX MAX) the denitrification phase stops and the nitrification phase starts independent on NH_4-N or NO_3-N concentration or time frame. Use this function if an increased biological P-removal during the denitrification phase causes in unacceptable high PO_4-P concentration (Default CNP OVERRIDES MAX NIT. = NO).

Use the same input parameter for NH_4-N concentration to extend the nitrification phase if the concentration is more than the threshold and if this function is selected. (CNP OVERRIDES MAX NIT. = YES)

5.2.12 Load dependent DO concentration during nitrification

Based on the measured NH_4-N and NO_3-N concentration at the beginning of the nitrification period a applicable DO concentration during the nitrification is automatically calculated (only for N/DN on standardized combined). The SETPOINT DO MIN sets the minimum DO concentration for nitrification, the SETPOINT DO MAX set the maximum DO concentration for nitrification.

5.2.13 Set the aeration control with stages

Oxygen controllers with stages actuation are min-max limit controllers that get an additional time rating. This time rating examines the change rate. The parameters MAX DO and MIN DO give an upper and lower DO limit value. If the DO concentration is more than MAX DO the controller sets down an aeration stage. If the DO concentration is less than MIN DO the controller sets the aeration stages higher. The controlled DO set point is the average concentration between MAX DO and MIN DO. (Default MAX DO = 2.0 mg/L, MIN DO = 0.8 mg/L)

The controller use the derivative time to react to the change rate of DO concentration. So the controller can react more quickly to the deviations from the objective value. (Default DERIVATIVE TIME = 0 min)

5.2.14 Set the aeration control with VFD control (and stages)

Stage 1 and 2 are available analog outputs to control VFD.

Note: *The service of supplier prepares the DO control, different types of blowers or aeration stages on the CF-card of the RTC module.*

Oxygen controllers with an additional VFD control are closed-loop controllers with an integral part to control a DO set point during the nitrification phase.

To influence the reaction of blower intensity by VFD adapt the proportional factor P GAIN DO and the integral part INT PART. A lower value for P GAIN DO and INT PART causes in a slower reaction from VFD, a higher value causes in a faster reaction from VFD. (Defalut: SETPOINT DO = 1.5 mg/L, P GAIN DO = 0.3 1/mg/L, DERIVATIVE TIME = 0 min., INT PART = 0.3)

5.2.15 Influence the aeration control with damping

The DO-controller contains a damping to prevent too frequent changes. A change procedure based on the duration since the last change and how often and how much a limit value was not achieved. If the DAMPING is increased, the change frequency between the aeration stages decreases and the limit values MAX DO, MIN DO and SETPOINT DO are more heavily not achieved.

5.2.16 Influence the aeration control with blocking times

BLOCKING TIMES and DAMPING prevent too fast change frequency of stages. Set a fixed minimum time for change the stages with the BLOCKING TIMES.

BLOCKING TIME FORW is the minimum running time in a stage before a change in same direction is possible (use again a higher aeration stage OR use again a lower stage).

BLOCKING TIME BACK is the minimum running time in a stage before a change in opposite direction is possible (use a higher stage after using a lower stage OR use a lower stage after using a higher stage).

Set a shorter time for BLOCKING TIME FORW. as for BLOCKING TIME BACK to get the DO set point faster. Set the BLOCKING TIME BACK to a longer time to prevent change back and forth around the set point. (Default: BLOCKING TIME FORW. = 5 min., BLOCKING TIME BACK = 10 min.)

5.2.17 Set the start stage parameters

Set with the START STAGE parameters an optimal procedure for the DO-control at the beginning of nitrification phase. At the beginning of nitrification a high DO is necessary. Start the aeration with a high aeration stage/intensity.

5.2.18 Select the mixing function

If the aeration basins have no stirrers installed for mixing the sludge during aeration is off, an aerator can be used to mix up the sludge.

5.2.19 Set the aerators parameters

Note: *The service of supplier prepares the aerators parameters on the CF-card of the RTC module.*

If the aeration capacity of the first two blowers is very different (1:1.5 or higher) expand to three stages. The first stage is the small blower, the second stage is the large blower and the third stage is the sum of the small and large blowers.

5.3 RTC112 SD-module and RTC113 ST-module

5.3.1 Configure the RTC112 SD-module and RTC113 ST-module

The RTC112 SD-module is a system for sludge dewatering and the RTC113 ST-module is a system for sludge thickening. Each module are combined open- and closed-loop modules that are available as a 1-channel or 2-channel version.

1. Go to SELECT SENSOR and select the sensor installed for the open/closed-loop control. Refer to Add a sensor on page 17.
2. Select PRESELECT PROG to show the installed version. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

Option	Description
POLYMER DOSING CONTROL	Calculates the polymer dosing rate (in L/h) based on the feed flow rate and the measured TSS concentration from the influent. (Activation/deactivation) ***Note:*** *This open-loop control mode can only be started if FEED FLOW CONTROL is stopped. The polymer flow rate is controlled by the RTC.*
FEED FLOW CONTROL	Calculates the feed flow rate (in L/s) based on the measured TSS concentration and a specified polymer dosing rate. (Activation/deactivation) ***Note:*** *This open-loop control mode can only be started if POLYMER DOSING CONTROL is stopped. The feed flow rate is controlled by the RTC.*
CLOSED LOOP EFFLUENT CONTROL	Sets the specific polymer dosing rate FACTOR POLYMER DOSING based on the difference between the objective and actual TSS concentration in the thickened sludge. Sets the TSS load fed with the sludge thickening based on the difference between the objective and actual TSS concentration in the filtrate, if FEED FLOW CONTROL is started. A change in the specific dosing rate has an effect on the polymer dosing rate in the POLYMER DOSING CONTROL module and on the feed flow rate in the FEED FLOW CONTROL module. (Activation/ deactivation) ***Note:*** *The closed-loop control mode can only be started if POLYMER DOSING CONTROL or FEED FLOW CONTROL is stopped. Activate/deactivate the setting of CLOSED-LOOP EFFLUENT CONTROL on the CF-card.*
CLOSED-LOOP FILTRATE CONTROL	Sets the specific polymer dosing rate FACTOR POLYMER DOSING based on the difference between the objective and actual TSS concentration in the filtrate/centrate. (Only applies to RTC112 SD-module.) Sets the TSS load fed with the sludge thickening based on the difference between the objective and actual TSS concentration in the filtrate, if FEED FLOW CONTROL is started. A change in the specific dosing rate has an effect on the polymer dosing rate in the POLYMER DOSING CONTROL module and on the feed flow rate in the FEED FLOW CONTROL module. (Activation/ deactivation) ***Note:*** *The closed-loop control mode can only be started if POLYMER DOSING CONTROL or FEED FLOW CONTROL is stopped. Activate/deactivate the setting of CLOSED-LOOP FILTRATE CONTROL on the CF-card.*

3. Select CONTROL PARAMETER and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

Option	Description
FACTOR POLYMER DOSING	Sets the necessary specific polymer dosing (in g/kg) based on the TSS are fed by the machine.
POLYMER CONCENTRATION	Sets the polymer concentration (in g/L) fed with the polymer pump.
MANUAL POLYMER DOSING	Shows the polymer flow rate (in L/h) if • FEED FLOW CONTROL is started. • The TSS measurement from the influent reports an error. • The flow measurement from the influent reports an error.

Option	Description
MANUAL FEED FLOW	Show the feed flow rate (in L/s) if • POLYMER DOSING CONTROL is started. • The TSS measurement from the influent reports an error. • The flow measurement from the influent reports an error.
MAX DECREASE CLOSED L	Sets the maximum decrease of the specific polymer dosing rate FACTOR POLYMER DOSING (in g/kg) if CLOSED LOOP EFFLUENT CONTROL is selected.
MAX INCREASE CLOSED L	Sets the maximum increase of the specific polymer dosing rate FACTOR POLYMER DOSING (in g/kg) if CLOSED LOOP EFFLUENT CONTROL is selected.
SET-POINT TSS	Sets the necessary set point of the TSS concentration in the thickened sludge (in g/L). ***Note:*** *Only if CLOSED LOOP EFFLUENT CONTROL is started.*
P GAIN TSS	Sets the proportional gain for the PID closed-loop controller for the TSS concentration in the thickened sludge (in L/g). ***Note:*** *Divide P GAIN TSS with 100, then multiply it with the difference of the actual TSS concentration to the necessary TSS set point.*
INTEGRAL TIME TSS	Sets the integral time for the PID closed-loop controller for the TSS concentration in the thickened sludge (in minutes). ***Note:*** *Set the INTEGRAL TIME TSS to 0 to stop the integral part of the PI open-loop controller.*
DERIVATIVE TIME TSS	Sets the derivative time for the PID closed-loop controller for the TSS concentration in the thickened sludge (in minutes).
SET-POINT FILT	Sets the necessary set point of the TSS concentration in the centrate/filtrate (in g/L). ***Note:*** *Only if CLOSED LOOP FILTRATE CONTROL is started.*
P GAIN FILT	Sets the proportional gain for the PID closed-loop controller for the TSS concentration in the centrate/filtrate (in L/g). ***Note:*** *Divide P GAIN FILT with 100, and then multiply it by the difference of the actual TSS concentration to the necessary TSS set point.*
INTEGRAL TIME FILT	Sets the integral time for the PID closed-loop controller for the TSS concentration in the centrate/filtrate (in minutes). ***Note:*** *Set the INTEGRAL TIME FILT to 0 to stop the integral part of the PI open-loop controller.*
DERIVATIVE TIME FILT	Sets the derivative time for the PID closed-loop controller for the TSS concentration in the centrate/filtrate (in minutes).

4. Select INPUT/OUTPUT LIMITS and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

Option	Description
FEED FLOW STOP DOS	Stops the polymer dosing if feed flow to the machine is less than the selected percentage FEED FLOW STOP DOS multiplied with FEED FLOW LOW. Use this parameter to prevent thickening/dewatering machinery from clogging in times of very low feed flow.
FEED FLOW LOW	Sets feed flow rate input signals less than this value to this value (in L/s) (to prevent low flow peaks).
FEED FLOW HIGH	Sets feed flow rate input signals more than this value to this value (in L/s) (to prevent high flow peaks).

Option	Description
FEED FLOW SMOOTHING	Decreases fluctuations in the feed flow measurement values (in minutes). Refer to Decrease the fluctuation of the measurement values on page 37.
LIMIT TSS IN LOW	Sets TSS measurement values from the influent less than this value to this value (in g/L) (to prevent low peaks).
LIMIT MAX TSS IN HIGH	Sets TSS measurement values from the influent more than this value to this value (in g/L) (to prevent high peaks).
TSS IN SMOOTHING	Decreases fluctuations in the TSS measurement values from the influent (in minutes). Refer to Decrease the fluctuation of the measurement values on page 37.
LIMIT TSS OUT LOW	Sets the TSS values of the thickened sludge less than this value to this value (in g/L) (to prevent low peaks).
LIMIT TSS OUT HIGH	Sets the TSS values of the thickened sludge more than this value to this value (in g/L) (to prevent high peaks).
TSS OUT SMOOTHING	Decreases fluctuations in the TSS measurement values from the effluent (in minutes). Refer to Decrease the fluctuation of the measurement values on page 37.
POLYMER DOSING MINIMUM	Sets the RTC calculations less than this value to this value and supplies to the polymer pump (in L/s). ***Note:*** *When FEED FLOW CONTROL is started, measurement values for the polymer dosing rate less than this value are set to this value (to prevent low peaks in the dosing flow).*
POLYMER DOSING MAXIMUM	Sets the RTC calculations more than this value to this value and supplies to the polymer pump (in L/s). ***Note:*** *When FEED FLOW CONTROL is started, measurement values for the polymer dosing rate more than this value are set to this value (to prevent high peaks in the dosing flow).*

5. Select INPUTS and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN FEED FLOW	Sets the minimum flow rate from the influent based on the 0/4 mA measurement signal (in L/s).
MAX FEED FLOW	Sets the maximum flow rate from the influent based on the 20 mA measurement signal (in L/s).
0/4...20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.
MIN POLYMER FLOW	Sets the minimum polymer dosing based on the 0/4 mA measurement signal (in L/h).
MAX POLYMER FLOW	Sets the maximum polymer dosing based on the 20 mA measurement signal (in L/h).
0/4...20MA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.

6. Select OUTPUTS and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN FEED FLOW	Sets the minimum flow rate from the influent based on the 0/4 mA measurement signal (in L/s).
MAX FEED FLOW	Sets the maximum flow rate from the influent based on the 20 mA measurement signal (in L/s).
0/4...20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument
MIN POLYMER FLOW	Sets the minimum polymer dosing based on the 0/4 mA measurement signal (in L/h).
MAX POLYMER FLOW	Sets the maximum polymer dosing based on the 20 mA measurement signal (in L/h).
0/4...20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.
CONTROL CYCLE	Includes the ON and OFF time of the polymer pump open-loop control (in seconds). The control cycle time (CONTROL CYCLE) have an effect on the on/off duration in pulse/pause mode. For example, with a cycle time of 100 seconds and a dosing control value of 60%, the dosing pump is periodically set to on for 60 seconds and set to off for 40 seconds. Short cycle times increase the change frequency.
MIN RUNTIME	Saves the dosing pump. The pump is not started for less than this time span (in seconds). The time must be a fraction of the control cycle time. The MIN RUNTIME must be shorter than the duration of the CONTROL CYCLE.

7. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

8. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
9. SET DEFAULTS restores the factory settings.

   Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

5.3.2 Decrease the fluctuation of the measurement values

Set SMOOTHING to decrease the fluctuation of the measurement values.

- SMOOTHING = 1. The signal for the measurement is not influenced.
- SMOOTHING = 2. The fluctuation of the measurement signal is decreased over 3 minutes.
- SMOOTHING = 3. The fluctuation of the measurement signal is decreased over 5 minutes.
- SMOOTHING = 5. The fluctuation of the measurement signal is decreased over 12 minutes.
- SMOOTHING = 10. The fluctuation of the measurement signal is decreased over 25 minutes.

Example: With the setting SMOOTHING = 2 , it gets 3 minutes for the value to have 95 % of the final value (after a sudden change).

5.4 RTC103 N-module

5.4.1 RTC103 N-module control programs

The four programs in Table 16 calculate the applicable DO concentration for nitrification supply an optimal adaptation to the local conditions and to the available measurement signals. If a measurement signal is temporarily not available, the program automatically refers to respective measurement still available (NH_4-N influent, NH_4-N effluent or TSS). If the measurements are available again, the program automatically refers to the selected program. The change between programs occurs with a delay of 5 minutes.

Table 16 RTC103 N-module control programs

NH_4-N influent nitrification	Calculates DO concentration based on NH_4-N load to nitrification, only.
NH_4-N influent and TSS	Calculates DO concentration based on NH_4-N load includes the current sludge retention time.
NH_4-N influent and NH_4-N effluent	Calculates DO concentration based on NH_4-N load to nitrification and NH_4-N effluent concentration.
NH_4-N influent, NH_4-N effluent and TSS	Calculates DO concentration based on NH_4-N load to nitrification and NH_4-N effluent concentration include the current sludge retention time.

5.4.2 RTC103 N-module versions

The module is available in a N control version and a DO stages control version (with and without VFD option). Each version is available as a 1-channel or a 2-channel version. The 2-channel version can control two activated sludge tanks. All of the key parameters are shown two times and are identified as channel 1 and channel 2. Also the 2-channel version has a percentage factor for distribution of the flowrate (DISTR. CHAN.1/CHAN.2).

The Qin flowrate signal is the sum signal for both channels. If the flow signal for channel 1 is available connect the signal at the analog input terminal for channel 1. Set the percentage to distribute to channel 1. If the flow signals for both channels are available, connect the signals to channel 1 and channel 2. Set DISTR. CHAN.1/CHAN.2 to 0. The distribution ratio is used for Qras, too.

5.4.3 Configure the N control version

1. Go to SELECT SENSOR and select the sensor installed for the RTC module. Refer to Add a sensor on page 17.
2. Select N-CONTROL and select an option.

Option	Description
SRT MODE	Selects one of two types of operation based on the aerobic Sludge Retention Time (SRT): • Manually—The SRT is supplied as a manual input to the controller if no TSS measurement is available in aeration tank • TSS mL—The SRT is calculated based on the MLSS concentration and the amount of daily removed TSS mass.
SRT (MANUALLY)	Sets the current TSS in the aeration tank as a manual input for the Sludge Retention Time. If the TSS signal is temporarily not available the controller refers to this value (in days).
DAILY SURPLUS MASS	Sets the amount of sludge daily removed from the process, if TSS measurement is available. Based on that amount, the MLSS concentration in the aeration tank and the aerated volume the SRT is calculated.

Option	Description
TSS MIXED LIQUOR	Uses this value for calculation, if TSS measurement is not available (in g/L).
COD-TKN RATIO	Sets the COD/TKN ratio. Examine a COD-related amount of NH_4-N included in the bio mass, to decrease the amount of NH_4-N by nitrification.
MIN NITRIFERS CONC.	Calculates the concentration of nitrifiers in the activated sludge (in %) based on the amount of NH_4-N nitrified during the last SRT. This concentration is necessary to find the DO set point. If the calculated concentration is less than the MIN NITRIFERS CONC., use the MIN NITRIFERS CONC. to find the DO set point.
MAX NITRIFERS CONC.	Calculates the concentration of nitrifiers in the activated sludge (in %) based on the amount of NH_4-N nitrified during the last SRT. This concentration is necessary to find the DO set point. If the calculated concentration is more than the MAX NITRIFERS CONC., use the MAX NITRIFERS CONC. to find the DO set point.
MODEL CORRECTION FACT.	Adjusts the DO concentration calculated by the model.
SUBSTIT. DO FOR MODEL	Supplies the DO feed forward set point for all calculations, if a measurement (NH_4-N, TSS, Flow) is temporarily not available (in mg/L).

3. Select NH4-N SETPOINT.
4. If the NH_4-N measurement in effluent for feedback control is available select an option.

Option	Description
P FACT NH4	Sets the proportional factor for the PID closed loop controller for the NH_4-N concentration effluent aeration (in 1/mg/L).
INTEGRAL TIME NH4	Sets the integral time for the PID closed loop controller for the NH_4-N concentration in the effluent aeration (in minutes). ***Note:*** *Set the INTEGRAL TIME NH4 to 0 to stop the integral part of the PID controller.*
DERIVATIVE TIME NH4	Sets the derivation time for the PID closed loop controller for the NH_4-N concentration effluent aeration (in minutes). ***Note:*** *Set the DERIVATIVE TIME NH4 to 0 to stop the derivative part of the PID controller.*

5. Select LIMITS and select an option.

Option	Description
SETPOINT DO MIN	Sets the calculated DO set point less than the SETPOINT DO MIN value to this value (in mg/L).
SETPOINT DO MAX	Sets the calculated DO set point more than the SETPOINT DO MAX value to this value (in mg/L).
SMOOTHING	Decreases fluctuations in the calculated DO set point, for more economical blower control (in minutes).

6. Select INPUTS and select an option. Refer to Input setting on page 42. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN INFLOW	Sets the minimum flow rate from the influent based on the 0/4 mA measurement signal (in L/s).
MAX INFLOW	Sets the maximum flow rate from the influent based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.

7. Select 0/4…20mA and select an option. Use this input for Q_{reci} or for Q_{ras}.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN RECIRCULATION	Sets the minimum recirculation flow rate based on based on the 0/4 mA measurement signal (in L/s).
MAX RECIRCULATION	Sets the maximum recirculation flow rate of influent based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument. ***Note:*** *If the input is not connected to the 0/4 to 20 mA calculate ratio to* Q_{inflow}.
Q RECI RATIO	Calculates the RECI flow based on the mA input signal, if the value Q RECI RATIO is set to 0. If the value is different from 0 the RECI flow is calculated from the inflow: Q RECI= Q RECI RATIO × INFLOW within the limits of MIN RECIRCULATION and MAX RECIRCULATION (in %).
MIN RETURN SLUDGE	Sets the minimum return sludge flow rate based on based on the 0/4 mA measurement signal (in L/s).
MAX RETURN SLUDGE	Sets the maximum return sludge flow rate of influent based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.
Q RETURN RATIO	Calculates the RAS flow based on the mA input signal, if the value Q RETURN RATIO is set to 0. If the value is different from 0 the RAS flow is calculated from the inflow: Q RETURN = Q RETURN RATIO × INFLOW within the limits of MIN RETURN SLUDGE and MAX RETURN SLUDGE (in %).
DISTR. CHAN. 1/CHAN.2	The Qin flowrate signal is the sum signal for both channels. If the flow signal for channel 1 is available connect the signal at the analog input terminal for channel 1. Set the percentage to distribute to channel 1. If the flow signals for both channels are available, connect the signals to channel 1 and channel 2. Set DISTR. CHAN. 1/CHAN.2 to 0. The distribution ratio is used for Qras, too.

8. Select OUTPUT and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN DO SETTING	Sets the minimum DO set point based on the 0/4 mA signal (in mg/L).
MAX DO SETTING	Sets the maximum DO set point based on the 20 mA signal (in mg/L).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop for the DO set point signal.

9. Select VOLUME>VOLUME to set the aerated volume in m^3 for channel 1 and channel 2.
   Note: *If one channel of two channels is out of operation (revision, or seasons with low loads) set volume for this channel to 0 m^3. The RTC module transfers all flow rates to the channel that is still in operation.*
10. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

11. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
12. SET DEFAULTS restores the factory settings.

    Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

5.4.4 Configure the DO control version

The optional oxygen control adapts the aeration power to the necessary oxygen concentration. The oxygen control has up to six aeration stages per channel. The aeration stages operate with minimum-maximum limit controllers. The first two aeration stages are available as analog outputs to control variable frequency drives.

1. Go to SELECT SENSOR and select the sensor installed for the RTC module. Refer to Add a sensor on page 17.
2. Select N-CONTROL.
3. Select DO CONTROL and select an option. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

Option	Description
P GAIN DO	Sets the GAIN for the PD controller in 1/mg/L. (Only applies to VFD option.) Refer to Set the aeration control with VFD control (and stages) on page 32.
DERIVATIV.TIME	Sets the derivative time to the DO controller in minutes. Refer to Set the aeration control with VFD control (and stages) on page 32.
INT PART	Sets the integral part for the DO control. (Only applies to VFD option.)
DAMPING	Decreases the influence the change frequency between the aeration stages. For a lower change frequency between aeration stages set damping to more than 10 minutes. Refer to Influence the aeration control with damping on page 33.

Option	Description
BLOCKING TIME FORW.	Sets the minimum running time in an aeration stage before a change in same direction is possible (in minutes) (use again a higher aeration stage or use again a lower stage). Refer to Influence the aeration control with blocking times on page 33.
BLOCKING TIME BACK	Sets the minimum running time in an aeration stage before a change in opposite direction is possible (in minutes) (use a higher aeration stage after a lower stage was used or use a lower aeration stage after a higher stage was used). Refer to Influence the aeration control with blocking times on page 33.
SUBST AERATION	Sets the aeration stage and intensity if the DO measurement is temporarily not available.

4. Select MIXING and select an option. Refer to Select the mixing function on page 33.

Option	Description
MIXING PAUSE	Sets the time period without mixing (in minutes).
MIXING TIME	Sets the duration of mixing (in seconds). ***Note:*** *Use only aeration stage 1 for mixing.*
MIXING INTENSITY	Sets the intensity of mixing (10 to 100%) in aeration stage 1. (Only applies to VFD option.)

5. Select AERATORS and select an option.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
0/4...20mA	Selects the analog output. (Only applies to VFD option.)
VFD I MIN 1	Sets the limit for the analog output 1 to the value of minimum frequency for blower (in %). (Only applies to VFD option and if VFD is configured 0/4 mA = 0 Hz .)
VFD I MIN 2	Sets the limit for a second analog output (in %).
NO. OF STAGES	Shows the maximum number of controller aeration stages.
AERATION ALWAYS ON	Sets to off the last aerator during nitrification if the DO concentration is too high (NO/YES).
P MIN AERATOR 1	Sets a percentage aeration intensity at minimum frequency for aerator 1. (Only applies to VFD option.)
P MIN AERATOR 2	Sets a percentage aeration intensity at minimum frequency for aerator 2. (Only applies to VFD option.)
P MAX AER2/AER1	Sets the relation of maximum aeration intensities between the two VFD aerators. If the blowers have equal capacities, the value is 1 (1.5 to 4.0). Refer to Set the aerators parameters on page 33.

6. For the VFD option select OUTPUT>0/4…20mA to set the analog outputs to control VFD blowers. Transfer range of 0/4 to 20 mA current loop. For a 2-channel version, select CHANNEL 1 or CHANNEL 2.

5.4.5 Input setting

For each channel are two mA input connector available. The first is the flowrate signal (inlet or effluent of plant or lane). The second is the recirculation flow rate signal or the return sludge flow rate signal.

5.5 RTC111 SRT-module

The RTC-module calculates the necessary flow rate of SAS (surplus activated sludge) (in L/s) to make sure that the nitrification is stable.

The calculation is based on the MLSS concentration in the aeration tank and in the SAS. To get a stable nitrification at a certain temperature the SRT can either be calculated by the RTC based on:

- SRT = SF × 3.4 × $1.103^{(15-T)}$ (SRT: Necessary sludge retention time; SF: Safety factor (based on plant condition, catchment area), T: Temperature of activated sludge in aeration basin)
- or calculate for each month. Use TABLE based on the relation between the temperature and the necessary SRT. Refer to Configure the RTC111 SRT-module on page 43 step 3.

Make sure that the selection of maximum and minimum MLSS concentrations is correct to have enough amount of solids in the process or not to overload the secondary clarification.

5.5.1 Configure the RTC111 SRT-module

1. Go to SELECT SENSOR and select the sensor installed for the RTC module. Refer to Add a sensor on page 17.
2. Select CONTROL PARAMETER and select an option.

Option	Description
SRT MODE	Selects one of two types of operation based on the aerobic Sludge Retention Time (SRT): • MANUAL—The SRT is supplied as a yearly profile. • TEMPERATURE—The SRT is calculated based on the actual temperature measured in the process.
MIN SLUDGE DRAW OFF	Sets the minimum capacity of the surplus activated sludge pump (in L/s).
MAX SLUDGE DRAW OFF	Sets the maximum capacity of the surplus activated sludge pump (in L/s).
MIN TSS AERATION	Sets the minimum TSS concentration to keep in activated sludge tanks (in g/L) (possible during high temperature periods). A warning is shown if this limit is on.
MAX TSS AERATION	Sets the maximum TSS concentration to keep in activated sludge tanks (in g/L) (possible during low temperature periods). A warning is shown if this limit is on.
P GAIN TSS	Increases the surplus activated sludge pumping volume when the actual TSS concentration in aeration is very close to MAX TSS AERATION. If the actual TSS is the same as MAX TSS AERATION, the selected proportional factor is used to speed up surplus activated sludge pumping volume (in L/g).
SUBST. SLUDGE DRAW OFF	Supplies the sludge draw off if a measurement (quality or flow) is temporarily not available (in L/s). The warning W05: CH1: FALLBACK STRATEGY is shown if the default value is on.
SUBST. TSS EFFLUENT	Supplies the TSS effluent if a measurement (quality or flow) is temporarily not available (in L/s).
SMOOTHING	Decreases fluctuations in the calculated set point surplus activated sludge draw off (in minutes). The averaged value includes TSS aerated volume and effluent mass flow. Set SMOOTHING to minimum 30 minutes.

Option	Description
PERIOD SRT CALCULATION	Sets the time span to calculate the sludge retention time (in days). Select multiples of 7 to evenly show weekly work patterns.
MIN DO AEROBIC SRT	Sets a threshold to select DO concentrations. DO concentrations less than this level are not calculated as aerated time. DO concentrations more than this level are aerated time (in mg/L).
SRT SECURITY FACTOR	Calculates the necessary aerobic sludge retention time to follow the German guideline DWA A131 equation 5-1. Based on the guideline set the factor to 1.8 for less than 20.000pe plants and to 1.45 for more than 100.000pe plants. Too high or too small SRT SECURITY FACTOR causes in not optimal operational states of the plant.
SRT MIN	Sets the minimum aerobic sludge age to keep at all times (in days).
GAIN CORR	Sets a percentage for more than 0% to get the SRT set point faster. It is not necessary to use this parameter. Be careful with settings of more than 10%.

3. Select TABLE and select a month JANUARY to DECEMBER. Enter a manually selected aerobic sludge retention time for every month (in days). If the SRT MODE is set to MANUAL this is the necessary enter. To prevent drastic step changes from month to month the values are being interpolated and the selected SRT is in the middle of the month.
4. Select PUMPING TIME and select a day MONDAY to SUNDAY. Enter the necessary pumping time for every day (in hours). If the pumping time is set to 24h/day the surplus activated sludge draw off is not manipulated. If the pumping time is set to less than 24h/day the surplus activated sludge draw off is multiplied with 24×7 divided by the sum of all set values for one week.
5. Select an option to set the current loop for influent flow as supplied to the RTC. Set only one of the two flows (inflow or effluent, refer to step 6), the other one must be set to 0 for MIN and MAX. It is not possible to set both flows to 0 at the same time.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN INFLOW	Sets the minimum flow rate of influent based on the 0/4 mA measurement signal (in L/s).
MAX INFLOW	Set the maximum flow rate of influent based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.

6. Select an option to set the current loop for effluent flow as supplied to the RTC. If available this flow supplies at first to the RTC. If a MAX EFFLUENT is defined this parameter will be used—no matter what has been defined for INFLOW. Set only one of the two flows (inflow or effluent), the other has to be set to 0 for MIN and MAX. It is not possible to set both flows to 0 at the same time.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN EFFLUENT	Sets the minimum flow rate of effluent based on the 0/4 mA measurement signal (in L/s).
MAX EFFLUENT	Sets the maximum flow rate of effluent based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.

7. Select an option to set the current loop for surplus activated sludge flow as supplied to the RTC.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN SLUDGE DRAW OFF	Sets the minimum flow rate of surplus activated sludge based on the 0/4 mA measurement signal (in L/s).
MAX SLUDGE DRAW OFF	Sets the maximum flow rate of surplus activated sludge based on the 20 mA measurement signal (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.

8. Select OUTPUTS and select an option to set the current loop to supply surplus activated sludge pump.

   Note: *At the Standardized Combined RTC modules, all INPUT/OUTPUT signals must be configured at the sc1000 I/O modules.*

Option	Description
MIN SLUDGE DRAW OFF	Sets the minimum pump volume (in L/s) to make sure that the loading is stable of forthcoming machinery (e.g., sludge thickening).
MAX SLUDGE DRAW OFF	Sets the pump to an ON/OFF mode if MIN SLUDGE DRAW OFF is set to the same value as MAX SLUDGE DRAW OFF (in L/s).
0/4…20mA	Sets the transfer range of 0/4 to 20 mA current loop as set in connected flow measuring instrument.
CONTROL CYCLE	Has an effect on the on/off duration in pulse/pause mode. For example, with a cycle time of 3 hours and a draw off value of 60%, the SAS pump is periodically set to on for 108 minutes and set to off for 72 minutes. Short cycle times increase the change frequency.
MIN RUNTIME	Saves the SAS pump. The pump is not started for less than this time span (in minutes). The time must be a fraction of the control cycle time. The MIN RUNTIME must be shorter than the duration of the CONTROL CYCLE.

9. Select MODBUS and select an option.

Option	Description
ADDRESS	Shows the start address of an RTC module within the MODBUS network (default 41). To change the setting, contact technical support.
DATA ORDER	Specifies the register order within a double word (default NORMAL). To change the setting, contact technical support.

10. Select DATALOG INTRVL to set the interval in which the data is saved in the log file (in minutes).
11. SET DEFAULTS restores the factory settings.

    Note: *SET DEFAULTS deletes all user settings. All parameters set by the user will be lost.*

Section 6 Maintenance

⚠CAUTION

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

6.1 Maintenance schedule

Maintenance schedule on page 47 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 17 Maintenance schedule

Task	Interval
Examine for contamination and corrosion.	Application-specific
Examine the LEDs on digital output for error signals (LED off).	Application-specific
Examine the system and determine if the configuration has to be adjusted.	Application-specific

Section 7 Troubleshooting

7.1 Warnings

Warning	Description	Solution
MODBUS ADDRESS	The RTC menu SET DEFAULTS was selected. This deleted the Modbus address of the RTC module in the sc1000 controller.	Access the following menu and set the correct MODBUS address. Go to: MAIN MENU>RTC MODULES/PROGNOSYS> RTC MODULES>RTC> CONFIGURE>MODBUS> ADDRESS.
PROBE SERVICE	A configured sensor is in service mode.	Go to the TEST/MAINT menu of selected sensor and end the SERVICE mode.
SENSOR MISSING	A selected sensor was disconnected from the sc1000 network.	Connect the sensor to sc1000 network again.
SENSOR FAIL	A selected sensor shows an error.	Look at the error mode of selected sensors. Refer to the sensor documentation for troubleshooting information.
SENSOR EXCEPTION	A selected sensor supplied an unknown signal to the sc1000 network.	Contact technical support.
CH1: FALLBACK STRATEGY	Channel 1 of the RTC module started the substitutional strategy.	Channel 1 of the RTC module started the substitutional strategy (e.g., missing measurement values).
CH2: FALLBACK STRATEGY	Channel 2 of the RTC module started the substitutional strategy.	Channel 2 of the RTC module started the substitutional strategy (e.g., missing measurement values).
ANALOGUE INPUT1 FAULTY	RTC analogue input signal is defective.	Fix the analogue signal supply to RTC module.
ANALOGUE INPUT2 FAULTY		
ANALOGUE INPUT3 FAULTY		
ANALOGUE INPUT4 FAULTY		
LIMIT ACTIVE	A user-defined parameter sets a limit for the RTC operation.	If necessary, make sure that the limiting parameters are correctly set. Make necessary adjustments.
CHECK "SELECT SENSOR"	RTC module receives less measurement values than necessary. This warning likely occurs with the SENSOR MISSING warning.	Make sure that all necessary instruments are selected in the SELECT SENSOR menu.

7.2 Errors

Error	Description	Solution
RTC MISSING	There is no communication between RTC module and RTC communication card.	Supply RTC module with voltage. Examine the connection cable. Set the power of the sc1000 and the RTC module to off. Wait until the system is completely voltage free. Set the power of the sc1000 controller and the RTC module to on.
RTC CRC	The communication between RTC module and RTC communication card was cancelled.	Make sure that the +/- connections of the connector cable between RTC and RTC communication card in the sc1000 are installed correctly. Make the necessary changes.
CHECK CONFIG	The sensor selection of the RTC module was removed by removal or selection of a new sc1000 controller.	Go to: MAIN MENU>RTC MODULES/PROGNOSYS>RTC MODULES>RTC> CONFIGURE>SELECT SENSOR, select the correct sensor for the RTC again and confirm.

Error	Description	Solution
TOO MANY PROBES	Too many sensors selected in the SELECT SENSOR menu.	Go to the SELECT SENSOR menu. Select no more than 15 probes.
TOO MANY MEASUREMENTS	The probes selected in the SELECT SENSOR have too many measurements to be operates by the RTC communication card.	Go to the SELECT SENSOR menu. Select the number of probes that have no more than 15 measurement values.
RTC FAILURE	A general reading/writing error of on CF card, which was most likely caused by a brief interruption to the power supply.	Acknowledge the error. If the message frequently shows, remove the cause of power disruptions. If necessary, contact technical support.
SYNTAX ERROR	Error in PROGNOSYS *.bin- file.	Use an updated version of PROGNOSYS that does not show this error. Contact technical support.
FORMULA TO LONG		
ARGUMENT		
LOGIC FUNCTION		
BOUNDARY FUNCTION		

7.3 Set the maintenance settings

1. Go to the MAIN MENU.
2. Select RTC MODULES / PROGNOSYS>RTC MODULE>RTC>MAINTENANCE.
3. Select RTC DATA and select an option.

Option	Description
RTC MEASUREMEN	Shows a maximum of five measured values. Use the up and down arrows to select more values.
RTC ACTUAT VAR	Shows a maximum of five actuating variables. Use the up and down arrows to select more variables.

4. Select DIAG/TEST and select an option.

Option	Description
EEPROM	Starts the hardware test.
RTC COMM TO	Shows the communication time-out.
RTC CRC	Shows the communication checksum.
MODBUS ADDRESS	Shows the setting of the address (default 41).

5. Select LOCATION to set a location name for better identification of the RTC module.
6. Select SOFTWARE VERSION to show the version number for service.
7. Select RTC MODE to show the mode set in the RTC module.
8. Select RTC VERSION to show the software version of the RTC module.

Section 8 Replacement parts and accessories

⚠WARNING

Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Quantity	Item no.
DIN rail NS 35/15 (DIN EN 60715 TH35), galvanized steel, 35 cm (13.78 in.) length	1	LZH165
Transformer, 90–240 V AC, 24 V DC, 0.75 A (for DIN rail NS 35/15)	1	LZH166
Terminal block for 24 V connection, without power supply	1	LZH167
Terminal block, grounding	1	LZH168
SUB-D connector	1	LZH169
Circuit breaker, C2	1	LZH170
CPU base module, including Ethernet port (CX1010-0021), passive ventilation element, RS-422/485 connection module (CX1010-N031)	1	LZH171
Power supply module, consisting of a bus coupler and a 24 V terminal module (CX1100-0002)	1	LZH172
Digital output module, 24 V DC, 2 outputs (KL2032)	1	LZH173
Digital output module, 24 V DC, 4 outputs (KL2134)	1	LZH174
Analog output module, 1 output (KL4011)	1	LZH175
Analog output module, 2 outputs (KL4012)	1	LZH176
Analog input module, 1 input (KL3011)	1	LZH177
Digital input module, 24 V DC, 2 inputs (KL1002)	1	LZH204
Digital output module, 24 V DC, 8 outputs (KL2408)	1	LZH205
Digital output module, 24 V DC, 16 outputs (KL2809)	1	LZH206
Bus termination module (KL9010)	1	LZH178
RTC communication card	1	YAB117
CF card, basic type for all RTC modules	1	LZY748-00
CF card, basic type for all RTC multi-channel modules, 8 GB	1	LZY748-A0

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