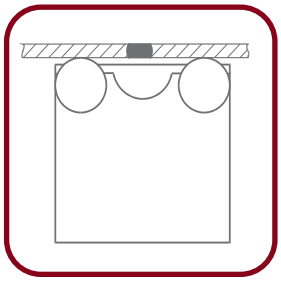
Weld Seam Detection System R4000 SND40

Weld Seam Detector SND40
for Coils, Wires, Cables and Lines



- Detection of butt welds and lashes
- Detection of changes in structure of material
- Magnetic Leak Flux and Eddy Current measuring principles
- Sensor signal in recorder-like visualization
- Industrial standard interfaces for automation
- Graphical user interface with 10 inch touchscreen
- Data backup via USB or Ethernet

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Declaration of conformity according to EC directives

Manufacturer:	Roland Electronic GmbH Otto-Maurer-Str. 17 DE 75210 Keltern
Product name:	**SND40**
Product type:	**Weld Seam Detection System R4000**

Roland Electronic GmbH declares that the product listed above complies with the requirements of the EMC directives listed below.

Applied Directives:

2014/35/EU	Low Voltage Directive EN61010-1: 2010	
2014/30/EU:	EMC Directive EN61000-6-2: 2005-08	EN61000-6-4: 2007-01

Date of mark's apposition: **24.06.2016**

Keltern, **24.06.2016**		Managing Director
Place, Date	*Signature*	*Function of the signer*

The declaration confirms the compliance with the cited directives. However, it is not any implied warranty of fitness for a particular purpose especially as it may relate to product liability.

The safety instructions and warnings must be observed.

ISO 9001 : 2008
Reg.-no. 5152 QM08

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1 Safety advice

1.1 Safety instructions and warnings for user

This manual contains all information required for the correct operation of the Roland Electronic equipment. It has been written for technically qualified personnel.

Unauthorized tampering with the unit, especially ignoring the warnings in this handbook, can cause malfunction and damage to the unit. Only authorized personnel should be allowed to make changes to the unit and perform cable connections especially the power supply.

Should it be necessary, e.g. in case of service or repair, to make measurements within the unit, then all customary accidents prevention procedures should be observed. Only professional electrical tools should be used.

Note The factory pre-settings – especially the upper / lower limit values – have been chosen such that an optimal machine protection is ensured.

Diverging settings can impair the machine protection.

Safety advice for persons with cardiac pacemakers!

Persons with cardiac pacemakers are to stay away from the sensors!

The strong magnetic / electromagnetic fields of the sensors can cause malfunction of cardiac pacemakers and other such apparatus!

1.2 Declaration of icons

Warning - general dangers!

Reference to imminent hazards, which can result in severe bodily harm or death.

Warning - dangers by high voltage!

Reference to imminent hazards due to electricity, which can result in severe bodily harm or death.

Attention - Damage of construction units!

Reference to a potential imminent situation, which can result in damage to the product or environs.

Note

Useful reference to an application or deepening information.

1.3 Fieldbus terminology

Within this manual the following Fieldbus specific expressions are used:

Term used in the manual	Fieldbus specific expression
Master	Scanner
Slave	Node
Baud rate	Data rate
Bus address	Mac ID / node address

2 System description

2.1 Glossary

Flat specimen	Under the aspect of weld seam detection, ”long“ products (such as coils, cables, wires, lines) are summarized under this term. Weld seam detection is oriented for transversal seams.
Round specimen	Under the aspect of weld seam detection, tubes and containers (such as cans, drums) are summarized under this term. Weld seam detection is oriented for longitudinal seams.

2.2 Intro

For processing of coil material and other “long“ products (e.g. cables, wires), which become united to larger units (e.g. metal coils with traversal weld seams, cable coils with connectors), detection of weld seams is required often.

The **Weld Seam Detection System SND40** can be used within these applications in the operation mode “*flat material*“.

2.3 System description und principle of measurement

For detecting of junctions the techniques of magnetic leak flux and eddy current evaluation are combined with methods of digital signal processing.

The utilized measuring principles require a dynamic measurement (the material must be moved relative to the sensor). The sensor becomes placed on the material or is guided in constant proximity to the material (sensors of the NS9…SC / EC9…SC series and eddy current probes, e.g. EC12x30IT10-100S) or the material is moved through the sensor (eddy current encircling coil systems).

▶ **Note:** The material needs to run with only little vibrations.

For controlling the detection, a link to the machine PLC is required. For this purpose a 8-bit parallel interface or a Fieldbus interface is installed at the SND40. In addition, the signal of a detected junction (weld seam signal) can be output via the built-in relay.

The machine PLC can start / stop the detecting procedure via an input and reset the weld seam signal via another input.

Via the same interface different programs can be selected also. Up to 30 programs are available.

2.4 Integration into a production facility

2.4.1 Functional sequence

In case of flat coil material the sensor is placed on the material at standstill. Then the material will be transported continuously. In case of round material such as cables and wires the material must be threaded through an encircling coil and will then be continuously transported while measuring. Under certain conditions, discontinuing operation (e.g. start / stop operation) is also possible.

The measurement procedure will now be started by the machine PLC (“Measurement start” signal). After the ”settling time” has elapsed, the measurement procedure starts. The measurement remains active until the “Measurement start“ signal is taken back or a malfunction occurs.

A seam is detected if the filtered sensor signal exceeds the switching threshold. Then the SND40 sets the “weld seam detected“ output. It remains set as long as the signal exceeds the switching threshold, but at least 50 ms. This time can be extended via the “switch-off delay“ parameter.

When the „acknowledge“ mode is set at the SND40, the output remains set until the machine PLC provides the “acknowledge weld seam” signal. This prevents the system from ignoring a short weld seam pulse.

2.4.2 Guidance of material and Sensor positioning device

Flat coil material as well as round material must be transported such that it runs as vibration-free as possible in the area of the sensor. If need be, the material must be guided via calming rollers or through draw stones.

Note!
Ensure a material run which is as calm as possible.

In case of coil material which cannot be fully calmed while threading-in and threading-out, it is useful to have a movable positioning aid at the machine which permits to move the sensor to a danger-free position during this phase.

2.4.3 Sensors

Caution! When handling sensors with permanent magnets, the hazard of squeezing and jamming exists.
The sensors must be kept away from magnet sensitive objects (credit cards, hard disks, diskettes, solenoid switches…).

For the SND40 various different sensors are available. Those can be divided into 3 main branches: The weld seam sensors (NS9... / EC9...SC series), the Eddy current probes (e.g. EC12x30IT10-100S) and the Encircling coil sensors.

The NS9… weld seam sensors are equipped with an electromagnet, which serves for magnetizing ferromagnetic material.

In general, the sensor suitable for the application will be determined at the ROLAND ELECTRONIC application laboratory. The present samples will be tested with different sensors, and the suitable sensor will be determined according to the signal quality.

The **weld seam sensors** are equipped with rollers made of Vulkollan®. The rollers provide for constant distance of the sensor element to the material surface.

For performing the measurement, the sensor is placed on the material surface with help of the movable positioning aid (which is required at the machine).

Note During measuring ferromagnetic material, a magnetical adhesive force will occur.

The sensor can be mounted in any orientation. Mounting the sensor ”from above“ (see following fig.) decreases the expenditure for cleaning. Furthermore, the weight of the sensor causes sufficient contact with the material, so no additional efforts are required.

NS9SC, installed in a coil cutting machine.

Fig. 1: NS9SC, application

The weld seam sensors should be mounted using suitable rubber mounts. So, mounting tolerances and smaller material motions can be compensated.

During the measurement the rollers are in contact with the material. This can be seen at the turn motion of the rollers during transporting the material.

Especially for thin material (thickness < 1 mm) a counter support is required. For this purpose a support roller block is in the scope of delivery.

The **eddy current probes** are delivered without rollers. Here also a constant distance between probe and material is important. In order to ensure this, a support roller block might be required from the machine side, depending on the situation. Eddy current probes are available in different kinds and shapes. For weld seam detection, so-called difference coils are used.

The **encircling coil systems** require guiding the material through a pipe-similar system. In case of material motions strongly affecting the inner surface of the system, an external protective measure (e.g. with draw stones) is useful. Encircling coil systems are available with various inner diameters. For measuring reasons, the diameter of the material is to fill the passage diameter of the sensor as much as possible, but must not be so large that the coil is touched by the material. Here, difference coils are used also.

2.4.4 Control unit SND40

The unit must be mounted at the machine such that the operator can monitor the screen and operate the unit during production and commissioning. In the ideal case he can also watch the detecting and positioning procedure.

2.5 Information for projecting

2.5.1 Measuring principles

Weld Seams in metals are characterized by geometrical, magnetical and electrical deviations from the original material. Those can occur in isolated form as well as in any shares.

The magnetical leakage flux principle is rigid method to detect weld seams, which appear as deviations in geometry and magnetical conductivity. Separating both effects from each other is hardly possible. Thus, scratches, grooves and the like can lead to interference signals which cause mistriggering of measurements.

The more sophisticated eddy current principle detects weld seams by deviations in magnetical and electrical conductivity and geometry. Here it is easier to suppress geometrical disturbances (scratches, grooves and the like). For narrow weld seams the eddy current principle is advantageous since a higher resolution is possible.

It is not possible to give a general statement about the detectability of weld seams. An investigation of material samples in the laboratory is always recommended.

2.5.2 Thickness / diameter of material

Ferromagnetic material is measured either by magnetical leakage flux or by eddy current. Therefore the material must be magnetized.

In case of measurement by leakage flux the material customarily will be completely magnetized. This means, that the max. material thickness is limited, due to the mechanical dimensions of the electromagnet. For the NS9… sensor this limit is at approx. 3mm.

In case of measurement by eddy current the electromagnet is used for pre-magnetizing the material. So the penetration depth of the eddy currents can be enlarged. Otherwise the so-called skin effect prevents from eddy currents forming in deeper areas.
The required penetration depth of the eddy currents for achieving a suitable measuring effect cannot be pre-determined. The upper limit regarding the material thickness can only be determined by an investigation of material samples in the laboratory.

Non-ferrous material is exclusively measured by eddy current. Limit values regarding material thickness / diameter must be determined by an investigation of material samples in the laboratory.

2.5.3 Velocity

The possible speed (surface speed) V depends on the sample rates set.

$10 < V < \frac{K}{A}$	V = Velocity [mm/s.]
	A = Sample rate per cm (setting in program parameter 5...30)
	K = 50.000

The program parameter *“Speed“* should - if possible - be set to the max. material speed expected.

2.5.4 Precision of positioning

The weld seam itself can considerably influence the triggering of the seam. The switching thresholds scatter the more, the less the seam signals emerge out of the noise.

Furthermore, the filter elements in the signal path from sensor to switching comparator also cause a delay, which can be up to 10ms depending on filter setting.

If a switch point accuracy of approx. 1mm is desired, this must be checked within an investigation in the laboratory.

2.5.5 Switching delay and resolution

After triggering a seam, the control unit switches with a delay time of 0.6ms. The deviation of switching time is ±0.2ms, which is valid only for optocoupler output ”Weld seam detected (pulse) and for “weld seam detected (continuously).

Thus, at a product speed of 5m/s a switching delay of approx. 3mm and a switching inaccuracy of approx. 1mm will result.

Resolution

A detected seam will switch the optocoupler output “Weld seam detected (pulse)“ for min. 50ms up to max. 100ms. Within this period no other seam will be reported. If another seam is detected within this period, the duration of the signal will be extended accordingly.

Thus, at a product speed of 5m/s the shortest seam-to-seam distance to be resolved is 0.5m.

Product speed in m/s	Resolvable distance in m
0.1	0.01
1.0	0.1
5.0	0.5

Note The statistical counter of the SND40 counts the intervals where seam events happened. When this counter value is compared with the number of switching events at the output, the values will not be identical since there all seam events are counted.

Note The relay output should not be used if positioning precision is important.

2.5.6 Reliability of detection

Due to progress in welding technology, especially the detection of weld seams is a currently challenging task. It cannot be excluded that there are products whose weld seams cannot be reliably detected.

Furthermore, scratches, grooves, material defects and the like can disturb the detection.

Thus, repeated missignals can result in unfavourable cases.

For this reason it is always advisable to perform an investigation at material samples.

Within such an investigation the optimal parameters for the product can be determined.

High detection reliability means:

- all really existing seams will be reported (ideal case)
- no errors due to scratches, material defects, misshapes or the like

Low detection reliability means:

- not all really existing seams will be reported
- appearance of errors due to scratches, material defects, misshapes or the like

Basically, the detection reliability can be derived from the signal-to-noise ratio (= signal level : noise level).

Detection reliability	Signal-to-noise ratio	Noise level at signal level 2V
high	> 10:1	0.2 V
medium	> 5: 1	0.4 V
low	> 2: 1	1 V

Signal shares caused by scratches, material defects, misshapes, knicks or marks or similar are also considered as “noise”.

Note The switching threshold is fixed at 1.25V (= 50% of full scale). For triggering a seam event the gain needs to be set such that the signal of the weld seam exceeds the switching threshold. The reliability is the better the more the gain can be increased and the signal is lifted above the switching threshold.

While increasing the gain, the noise will also be amplified. If the noise reaches the switching threshold, a mistriggering will be caused.

Thus it is important to have a large signal-to-noise ratio.

For difficult products it is useful to select specific settings (such as gain, frequency, filter).

For this purpose the SND40 provides for 30 program memory locations (selectable via PLC). For each product a memory location can be allocated.

Depending on the detection results, a combination in groups can be made even for different dimensions, materials and joining methods. Then one program is used for a whole product group.

In case of doubt it is better to create a program for each product.

2.6 Conditions for proper measuring operation

The requirements for the proper operation of the Weld Seam Detection System SND40 for Coils are:

The coil material must be even, it is **NOT ALLOWED** to have:

- undulations, bendings, knicks or any unevenness, such as marks.
- scratches with the same orientation of the Weld Seam to be detected.
- large areas with internal material defects, de-lamination or alloy change.
- no tinder skin that might flake off.

The Weld Seam is **NOT ALLOWED**

- to have any edge offset
- to be supernatant

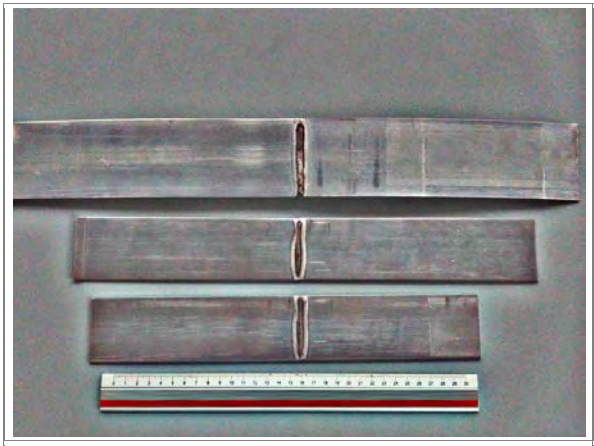	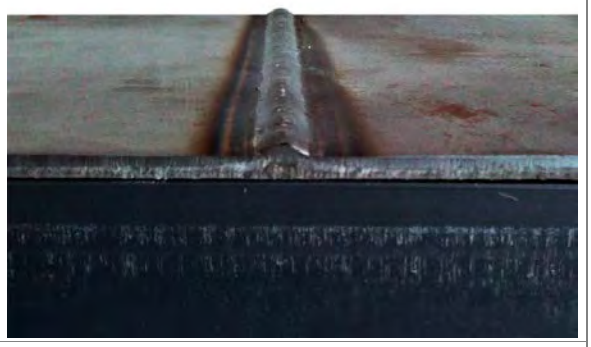
Material is uneven – not suited!	**Weld seam is supernatant – not suited!**

Fig 2: Examples for faulty coil material

The material transport must be continuous. During the measurement all plastic rollers of the sensor / the sensor bracket must contact the metal surface continuously and must rotate during material transport. It is very useful to make use of the support roller block as a counter bearing for the coil / sheet.

Attention must also be paid to the maximum and minimum transport velocity that must comply.

Exceptions are possible, which have been previously tested by the Roland Application Laboratory and classified as feasible.

Important!

Before planning any Weld Seam Detection it is always necessary to send a sample to the Roland Application Laboratory to check the feasibility.

For example an approval for operation has been given for coil sensors of NS9…SC series for following situations:

- minimal edge offset, less than 0.2 mm
- minimal supernatant, less than 0.2 mm
- discontinuous operation between 0 and 180 m/min at Coil Cutting Machines in Automotive Industry.

Important additional aspects:

- Correct sensor mounting, see chapter 4.1
- Compliance with ambient conditions, see chapter 2 “Technical Data”
- Correct installation of the Control unit and the cables, see chapter 5.1 “Cables”.

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3 Mounting

3.1 Mounting of sensor

The correct sensor mounting is the most important prerequisite for the proper function of the unit. Basically, the following must be noted:

- Avoid a rigid mounting of the sensor! The sensor must be mounted with elastic cushioning. Ensure a correct suspension by using the supplied rubber mounts and a lift cylinder, as shown in Fig. 23 below.
- It is not allowed to press the sensor against the coil / sheet with additional forces. The weight of the sensor is thereby sufficient.
  Ensure a proper support for the coil / sheet as a counter-bearing.
  We recommend the usage of the support roller block. (Within the scope of delivery or order separately.)
  The plastic rollers of the sensor are designed to prevent damaging the coil / sheet
- When mounting the sensor observe the transport direction of the material. The orientation of the Weld Seam must be in a right angle to the transport direction. On the active side, the sensor is completely closed.
- A proper function of the sensor is only possible if ALL sensor roller wheels have permanent and evenly contact to the coil / sheet.
  Respecting these prerequisites will guarantee the constant distance between sensor and coil / sheet. Variations of distance between the coil / sheet and the magnet poles of the sensor will cause changes of the leak flux and therefore may result the message "*weld seam*".
- Mount the sensor in such a way that visual inspection for roller wear and damage on the active surface can be easily checked.

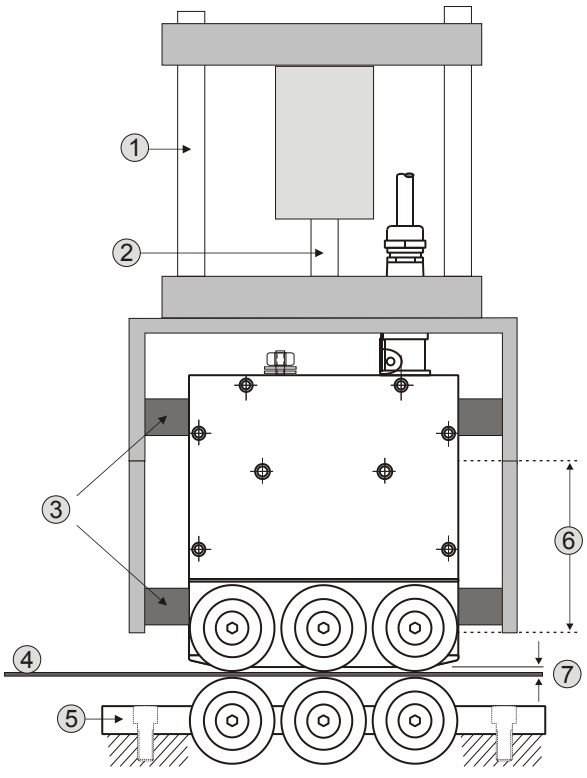
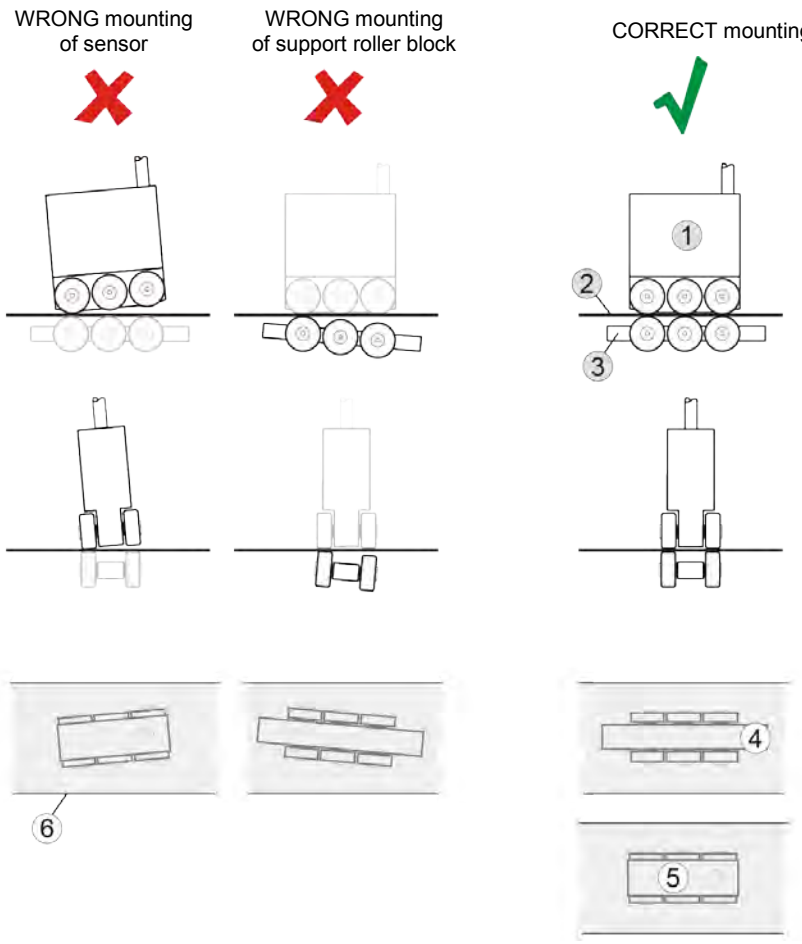


Fig. 3: Mounting the coil sensor

Mounting of sensor with support roller block	
1:	Parallel guidance
2:	Lift cylinder
3:	Rubber mounts
4:	Material to be measured
5:	Support roller block
6:	Lower part of the sensor holder possible from **S.N. 110314671**
7:	**Max. 1 mm distance**, e.g. on exchanging the rollers

Mounting errors, to be avoided under all circumstances:



Description	
1:	Sensor
2:	Coil, sheet
3:	Support roller block
4:	Support roller block
5:	Sensor
6:	Edge of material

Fig. 4: Mounting errors

3.1.1 Rubber mount assembly of the NS9 EC …

Six rubber mounts are included in the scope of supply.
In each case three buffers have to be installed on the narrow sensor sides (M8 thread holes).

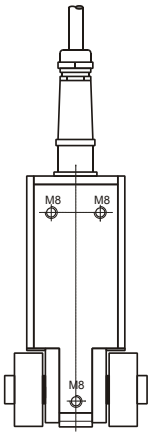


Fig. 5: Rubber mount assembly

3.2 Mounting of Eddy Current probes

Basically, an eddy current probe can be mounted in any orientation. However, an overhead mounting (probe face looking down) is favourable, since the probe will be less contaminated.

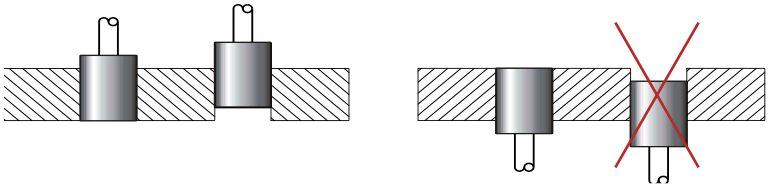
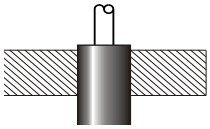


Fig. 6: Mounting of Eddy Current probes

The probe may be mounted flushed or recessed only in rigid plastic, ceramics or other non-conductive materials.

A recessed mounting protects the probe, but increases the air gap between material and probe. Furthermore, particles and scarfs can accumulate in the recess, which also can reduce the measuring capacity. Thus, mount the probe recessed only in overhead orientation.

Has the sensor been mounted in a holder with high electrical connectivity (e.g. Aluminum), then this material will extract energy from the sender in form of eddy current. This reduces the capability of the probe.

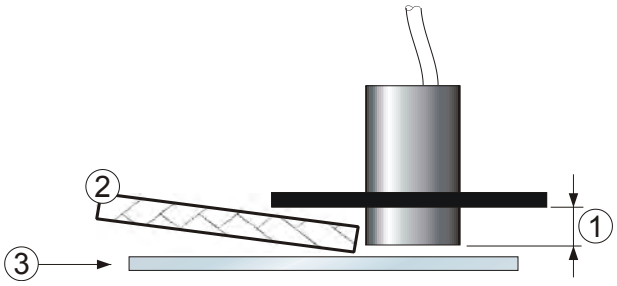


Non-flushed (standing-out) mounting can also be done in metallic holders. Then care for an utmost large distance between the active side of the sensor and the holder.

Fig. 7: Standing-out mounting of EC probes

Note:

When the probe is mounted in a holder made of steel, the probe should look of the holder for at least 10 mm. This can necessitate that the probe must be protected from damage by additional baffles.



Legend	
1:	Steel holders: Let the probe look out of the holder for more than 10mm. Plastic holders: Flushed mounting is practical.
2:	External baffle
3:	Transport direction of material

Fig. 8: Mounting of external baffles

Depending on the kind of probe, the correct distance between probe and material surface is at 0.3 ...1 mm.

The smaller the probe is, the smaller the correct distance is.

Since the distance between probe and material must be kept constant, it is essential to guide the probe on the material. Exception: the distance remains constant due to material guidance.

While measuring, the rear side of the material must be free from any metallic matter (especially support rollers, tapered guidance or mandrels), since this influences the measuring.

Structural irregularities (e.g. holes or grooves) will cause very strong interference signals.

Therefore, the probe should only be mounted in positions where the material structure is undisturbed.

Note:
Scratched or coarse surfaces also lead to strong interference signals.

The eddy current probe is defined for a defined direction of material flow. This means, the probe must be mounted according to the technical drawing.

Note:
If a probe is mounted 90° rotated, the measuring signal will be remarkably worse. The stated track width is then no longer correct.

3.3 Mounting of Encircling coil systems

The encircling coils, mainly consisting of the outer coil base, are equipped with guiding sleeves made of plastics (e.g. EC13x25**P**DN...) or of Stainless Steel (e.g. EC5x25**I**DN...). Those guiding sleeves serve for centring the material while transiting the sensor.

Fig. 9: Encircling coil sensor system

The sleeves as well as the coil body itself are not designed for taking up large forces. Thus the sensor system should be mounted at a location where the material is already calmed for running through the sensor.

Important For applications at which the material stresses the inner side of the sensor side, an external protective facility (e.g. with draw stones) is required.

Fig. 10: Protector for encircling coil sensor system

Basically, the sensor system can be mounted in any orientation.

Typically, the sensor system is screwed onto a rigid support (4 holes for M4 screws at housing).

The sensor system must be mounted such that the transport direction of the material is the same as the bold arrow on the housing shows.

On the cover lid there is the cable connection, which should not become blocked by other components. At the area of cable connection a free space of 100 mm must be scheduled for the cable and the connector.

Note The sensor system must not be exposed to extreme temperatures, radiation and mechanical load.

3.3.1 Protector for Encircling coil

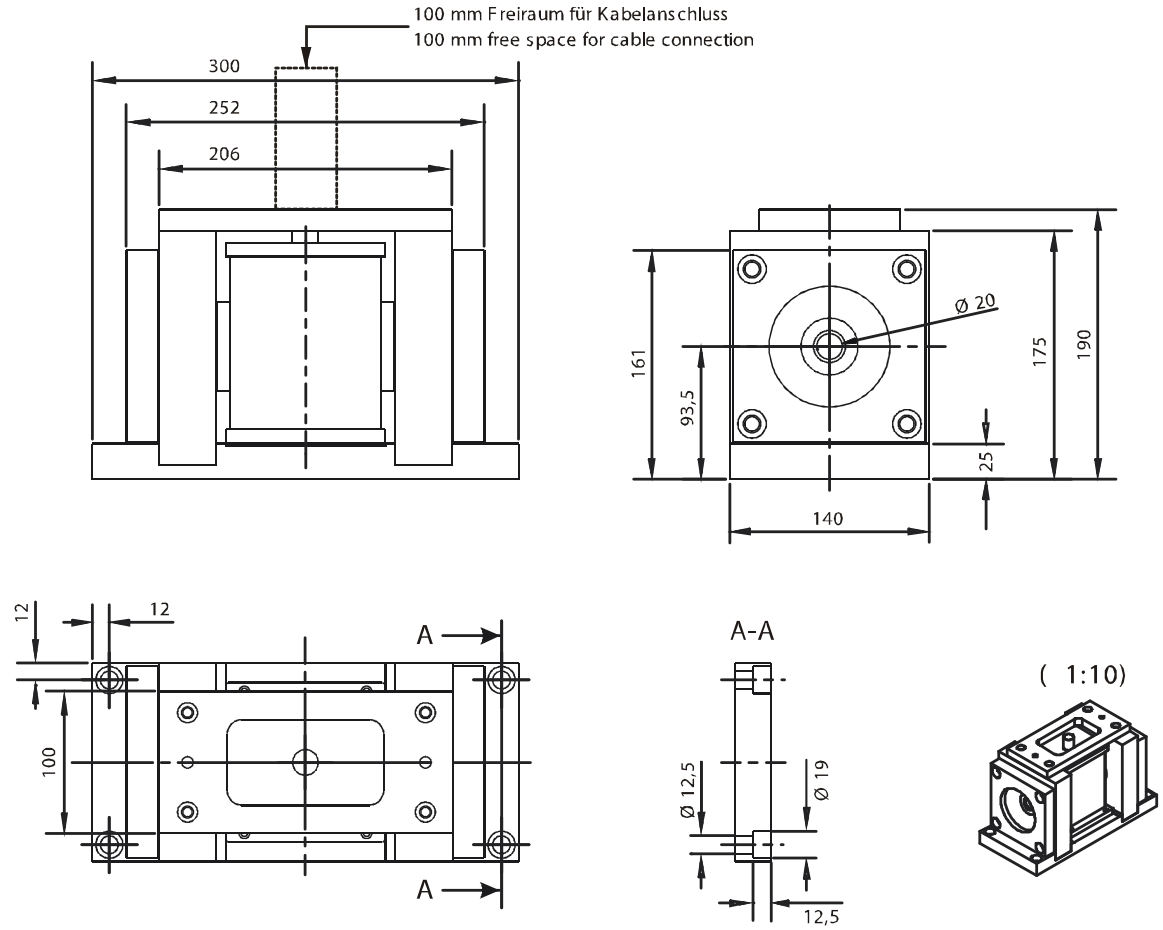


Abb. 11: Protector for encircling coil

3.4 Mounting the SND40 Control Unit

The control unit must be mounted such it can be monitored and easily operated during production. The place where the unit is mounted is to be safely accessible and clearly arranged. For service purposes it might be required to open the door from the rear. Attention must be paid to this fact when mounting the unit.

Ideally the unit is mounted at a place from which the sensor can be watched.

Note:

The unit must not be mounted within danger zones, otherwise operating and monitoring the unit is no longer possible without endangering.

The unit must not be exposed to extreme temperature, radiation or mechanical load.

The enclosure (Rittal, Type CP 6531.200) is prepared for the support arm system CP-L (round). The connection for the support arm is at the bottom side.

Note:

CAD files are available from Rittal in dxf and dwg format. The files can also be found on the Rittal CD-ROM "RiGeo" (Part No. SZ 2406.100). issue Febr. 2006.

Suitable components such as enclosure couplings, floor mounts, connecting adapters, inclination adapters and support arms are available from the Rittal Company.

Source: Finow
A rather simple solution can be implemented by using a tube with flange plates welded at the ends and thus creating a fixed floor mount.

Fig. 12: Mounting example of the SND40

4 Electrical installation

4.1 Cables

The sensor cables must not be laid out directly side by side with other unshielded lines potentially emitting strong electromagnetical interference radiation.

Such lines are e.g. servo motor cables or other cables carrying large pulsed currents.

In case of very strong interference sources the same applies also for the SND40 power supply cable and signal cable towards the control unit.

In order to reduce interferences, laying out the SND40 cables within separate EMC cable channels might be required.

All cables must be professionally laid out. Bending radii (see suppliers data sheets) must be kept to. Damages due to wearing / buckling must be avoided by circumspective installing.

Note:
Care for sufficient strain relief!

Damaged cables may never be used, they need to be replaced immediately.

If the cables cannot be used (e.g. due to missing UL/CSA permission), contact Roland Electronic for substitutes.

The provided snap-on cores are designated for a preventive protection from HF-interferences. These can be simply snapped on the connected cables.

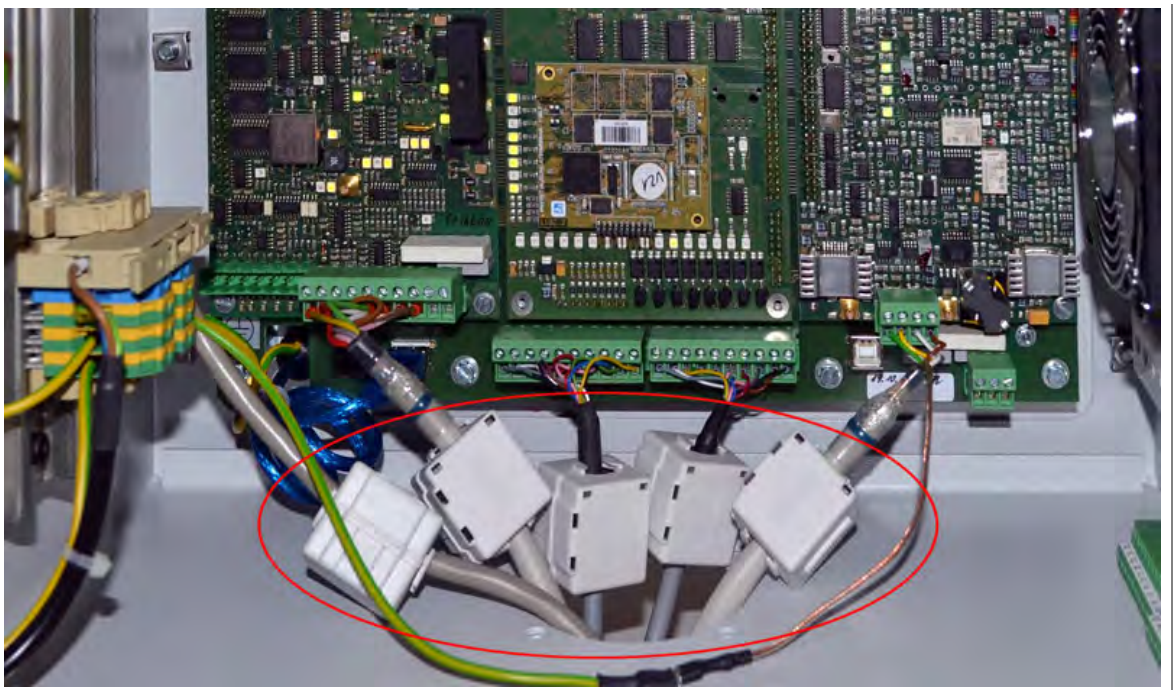


Fig. 13: Snap-on cores on power supply, sensor cables and PLC cables

4.2 Mains connection

The SND40 unit may only be connected to the mains power net by an electrician.

For connecting the wires at the terminal clamps use insulated splice ferrules in any case.

For details on the supply voltage see chapter ”*Technical data*“.

Note:

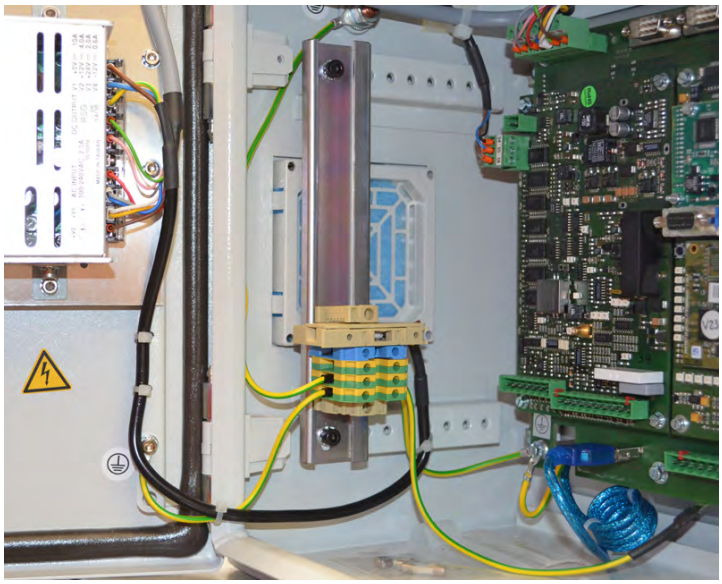
Always connect the protective conductor (PE) at the mains infeed.

For the connection to the mains net a cable of the type H05VV5-F (Lapp Oilflex® 140) 3x1,0/1,5mm² (or equivalent / better) is suitable.

For usage under severe interferences a shielded mains connection cable must be used, such as one of the type H05VVC4V5-K (Lapp Oilflex® 140CY).

The shielding must then be grounded at the feeding side. The cable needs to led-in via special EMC cable entries or EMC bulkhead screw fitting.

Alternatively, the shielding can also be connected (via metal cable ties) to the EMC base sheet of the enclosure (e.g. system Rittal).



Terminal diagram - Mains connection		
use insulated splice ferrules in any case!		
Colour of wire	**Info**	**Name**
brown	Fuse 3,15A medium-blow	L
blue		N
green-yellow	PE	
green-yellow		
green-yellow		

Fig. 14: Mains connection

4.3 Connection of PLC

4.3.1 Terminal diagram SND40

Terminal	Cable	Colour of wire	Direction	Voltage / current	Function	
6	Roland KNS9S-G or KNS9S-W	yellow	->	0...+/-20 mA R i = 100 Ohm	Leakage Flux signal input 1a	
7		red	->		Leakage Flux signal input 1b	
8		white	<-	+12 V DC / 0,1 A	Supply outputs f. Leakage Flux sensor	
9		brown **(+blue)***	<-	0 V DC (Common)		
10		green	<-	-12 V DC / 0,1 A		
11		grey	<-	0…48V DC	Supply for magnet coil +	
12		pink	<-		Supply for magnet coil –	
13		blank	<->		Shield (internally at protective conductor	
14	PLC		<->	max. 250 V AC / 6A max. 30 V DC / 6A	Motor relay 1 Closing contact (N.O)	
15			<->			
16	PLC		->	$U_{PowerIn}$ 13...30 V DC / 0,1 A	Ext. + 24V supply	
17			->		Ext. – 24V supply (common connection of all inputs); sinking input	
18			->	Low 0…4 V DC High 13...30 V DC I_{in} < 20 mA Sinking input	IN0	Function see chart of inputs
19					IN1	
20					IN2	
21					IN3	
22					IN4	
23					IN5	
24					IN6	
25					IN7	
26	PLC		->	$U_{PowerOut}$ 13...30V DC / 0,5A	Ext. + 24 V supply (common connection of all outputs); sourcing output	
27			->		Ext. – 24 V supply	
28			<-	Low: U_{out} < 4 V R_{load} > 1,2 kOhm High: U_{out} > $U_{PowerOut}$ - 2 V DC I_{out} < 50 mA Sourcing output	OUT0	Function see chart of outputs
29					OUT1	
30					OUT2	
31					OUT3	
32					OUT4	
33					OUT5	
34					OUT6	
35					OUT7	
36	Roland CECM18S-G	green	<-	max. 20 Vss unloaded	Output/a Eddy current transmitter	
37		yellow	<-		Output/b Eddy current transmitter	
38		white	->	max. 100 mVss	Input/a Eddy current receiver	
39		brown	->		Input/b Eddy current receiver	
Ground		transparent	<->	-	Shield (internal at ground connect)	
40	Reserve					
41						
42						
43						
44	PLC		<->	max. 250 V AC / 6A max. 30 V DC / 6A	Motor relay 2 opening contact (N.C.)	
45			<->		Motor relay 2 common (COM)	
46			<->		Motor relay 2 closing contact (N.O.)	
47	Internal wiring	pink		+24 V DC	Internal power supply (do not use for external applications)	
48		grey		0 VDC (Common)		
49		red		+5 V DC		
50		blue		D GND		
51		yellow-white		A GND		
52		green		–12 V DC		
53		brown		+12 V DC		
54		black		+24 V DC	Fan +	Fan
55		blue		0 V DC	Fan -	
56		brown		PWM	Tacho in	

Note: For cables delivered starting Nov. 2014 following applies:

***** A brown wire might be connected parallel together with a blue wire. This will **not affect** the proper functionality of the cable, the sensor or the control unit.

4.3.2 View at terminals

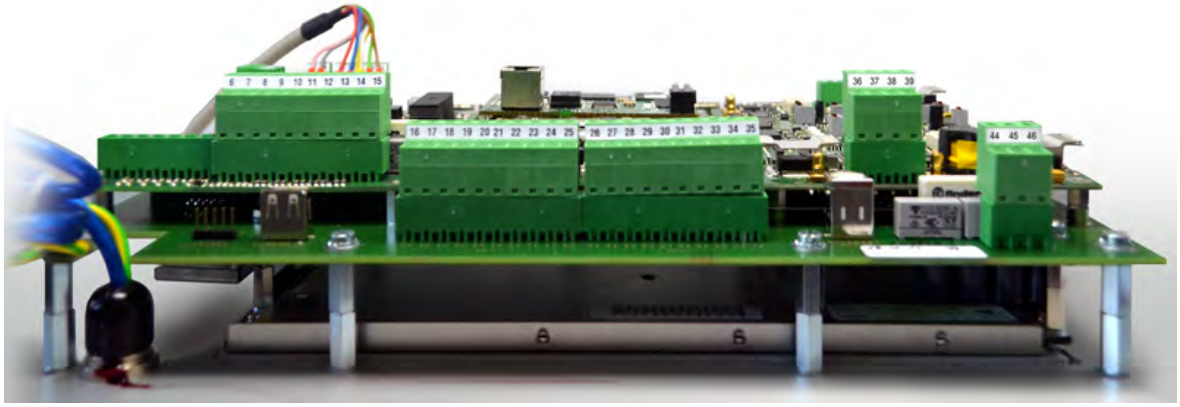


Fig. 15: SND40 View at terminals

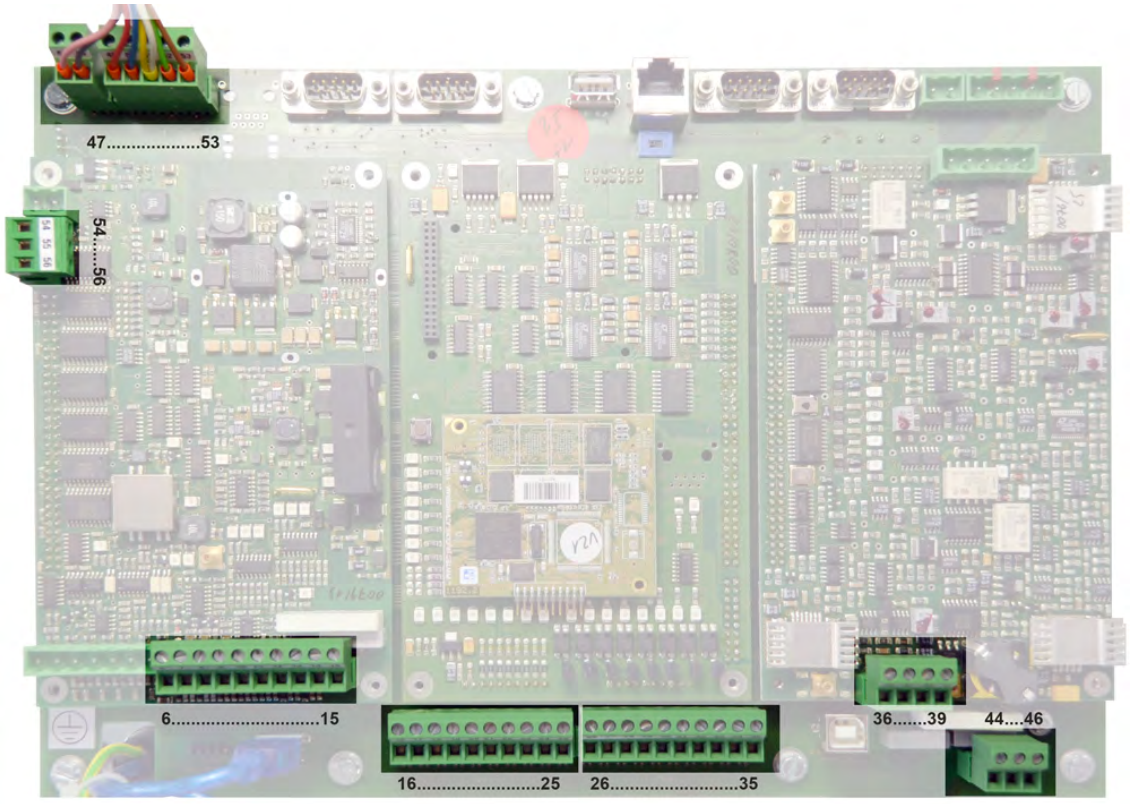


Fig. 16: Numeration of terminals

4.3.3 Operation mode “Flat material“

PLC signals

Inputs (PLC -> SND40)

IN	0	1	2	3	4	5	6	7
Terminal								
Function		Program selection	M1	M2	M4	M8	M16	
Function	Measurement Start/ Test job Start						Confirm weld seam	

The program will be addressed binary coded (”M1...M16“). *”Program selection“* serves as strobe.

Program No.	M1	M2	M4	M8	M16
1	1	0	0	0	0
2	0	1	0	0	0
3	1	1	0	0	0
...					
31	1	1	1	1	1

Program 0 does not exist. Selecting this program will cause an error message.

Outputs (SND40 -> PLC)

OUT	0	1	2	3	4	5	6	7
Terminal								
Function	Measurement Start active/ Test job Start active		ENABLE/ Ready for operation	Teach-in active	Weld seam detected (permanent)	Disorder general		Weld seam detected (pulse)
Function at Program selection		Program selection active	M1	M2	M4	M8	M16	

The signals OUT2 … OUT6 have two different functions. On *”Program selection“* they mirror the input signals IN2 … IN6 to the corresponding outputs.

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

4.4 Connection schedule – Leakage flux sensors

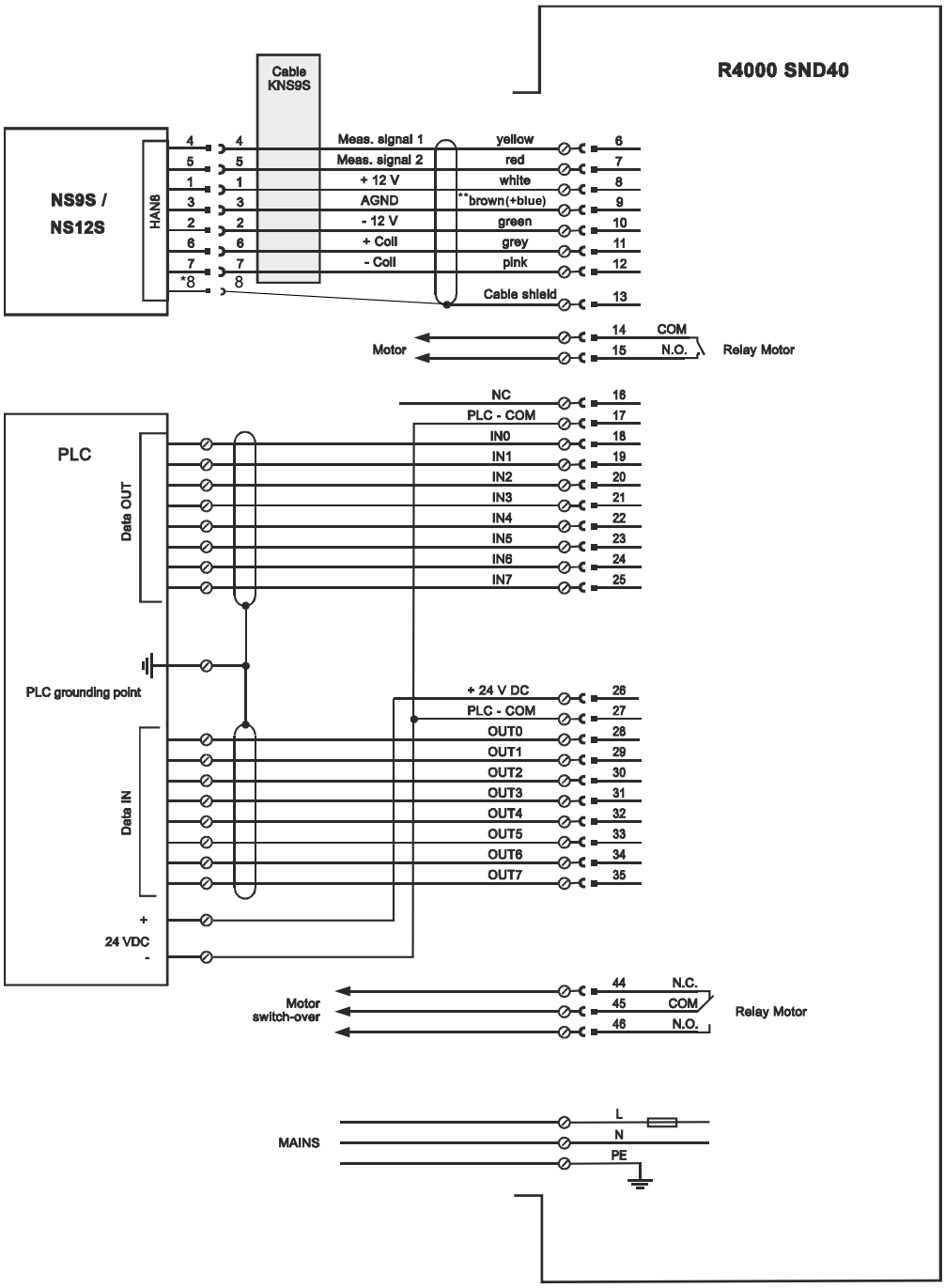


Fig. 17: Connection schedule for Leakage Flux Sensors

Note:

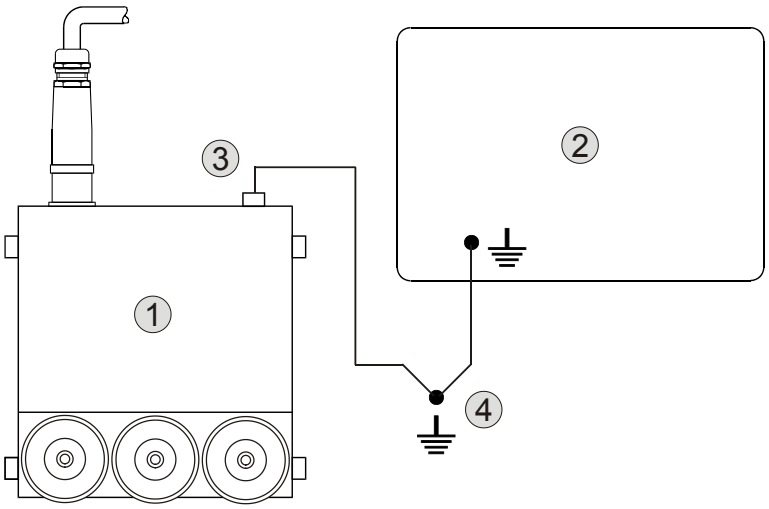
For cables delivered starting Nov. 2014 following applies:
*****Contact No. 8 might be connected with the cable shield.
** A brown wire might be connected parallel together with a blue wire. This will **not affect** the proper functionality of the cable, the sensor or the control unit.

4.5 Connecting of sensor

The sensor should be connected only by an electrician.

Special note:

When connecting the sensors, take care that the cable shields get connected with the provided terminals or flat contacts. If grounding connections are present at the sensors, they must be connected to grounding in every case.



Description	
1:	Sensor
2:	Control unit SND40
3:	Grounding terminal
4:	Central machine grounding

Fig. 18: Grounding

The sensor cable KNS9S-G and CECM18S-G are supplied by ROLAND ELECTRONIC. A different naming of the cable is possible - see „Technical data“. At the sensor side those cables are equipped with a round plug. The other side is prepared with splice ferrules.

The wires need to be connected to the assigned cable terminals. For doing so, the terminal strips can be detached.

4.6 Connection schedule - Combination sensors

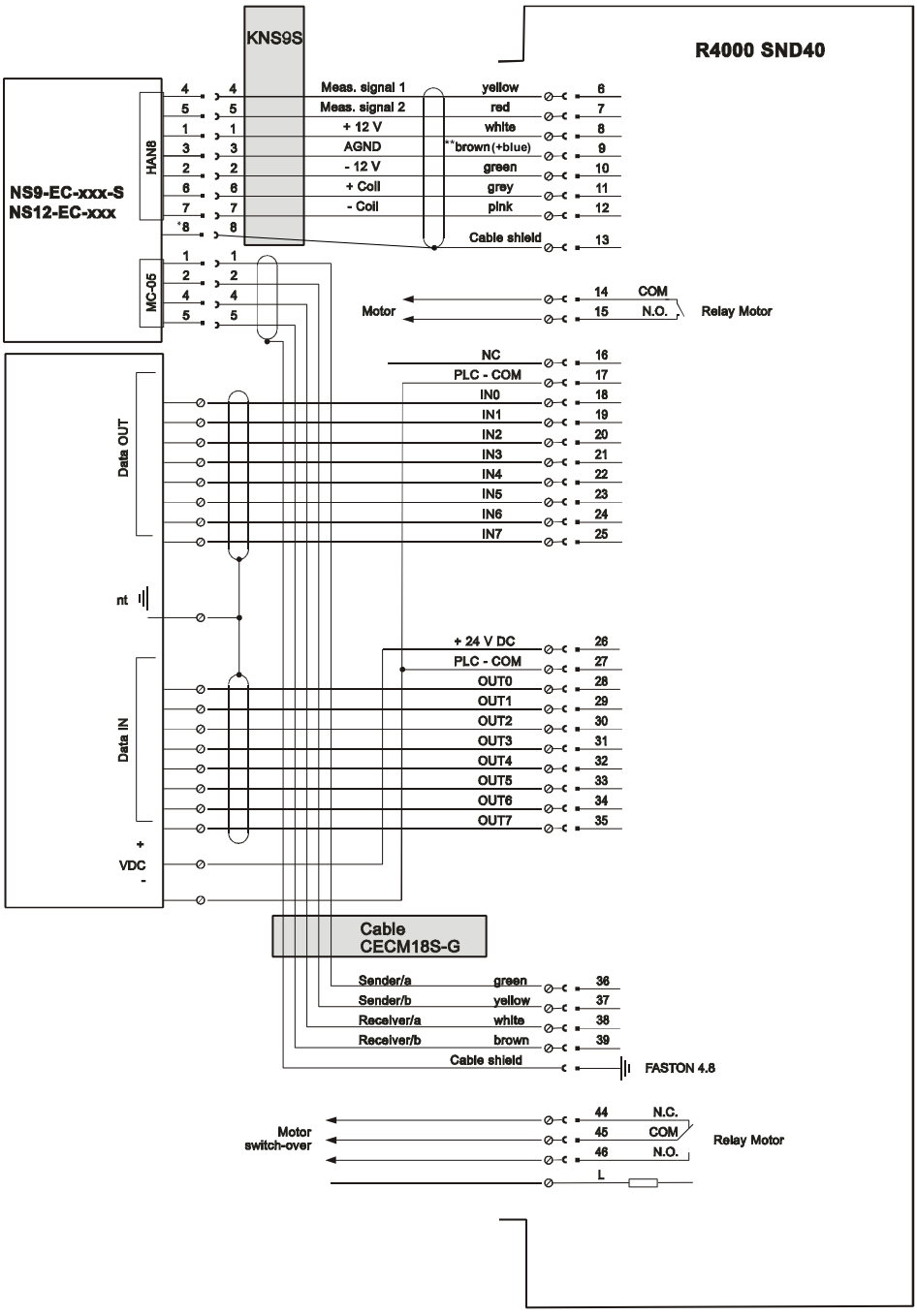


Fig. 19: Connection schedule – Combination sensors

Note:

For cables delivered starting Nov. 2014 following applies:
*Contact No. 8 might be connected with the cable shield.
** A brown wire might be connected parallel together with a blue wire. This will **not affect** the proper functionality of the cable, the sensor or the control unit.

4.7 Connection schedule – Eddy current sensors and Encircling coil systems

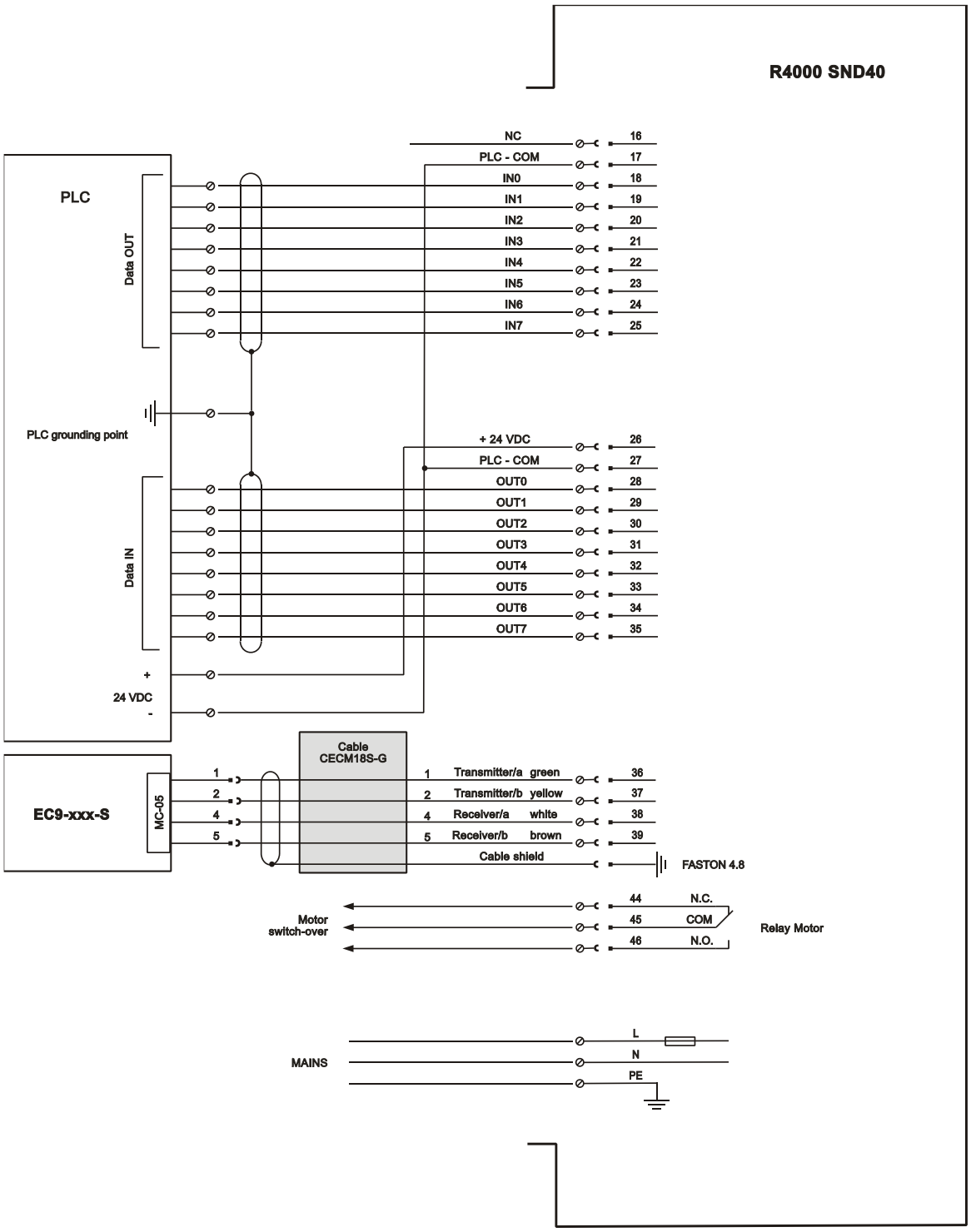
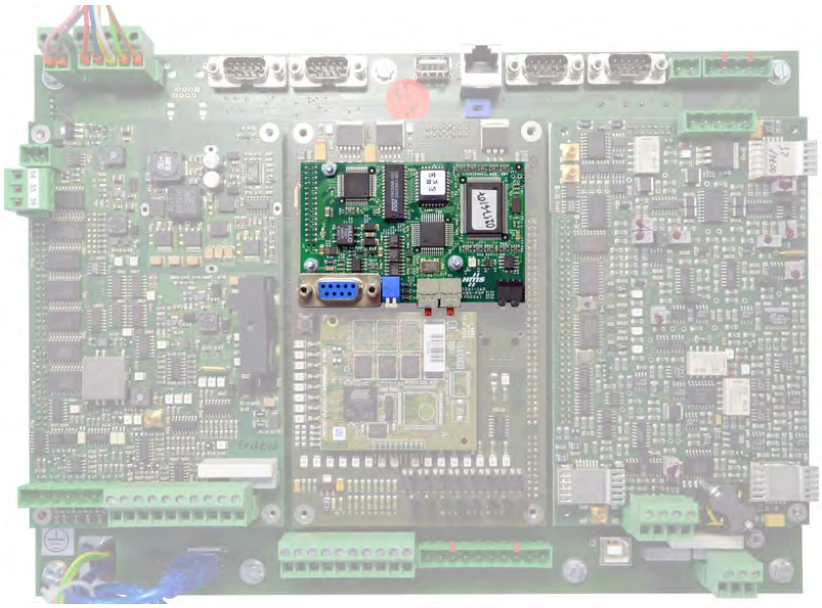


Fig. 20: Connection schedule for eddy current sensors and encircling coil systems

4.7.1 Profibus DP Connection

A Profibus-DP module is installed in units of the type SND40-(EC)-(MF)-PR.



Mainboard SND40
View of the Profibus DP module (type Anybus S, Supplier: HMS Industrial Networks).
For further details about Profibus interface please read chapter ”*Technical data*“.

Fig. 21: Mainboard Profibus module

Connection to the Profibus may only be done by an electrician.

Note:
For use as Profibus cable, the type “Unitronic® BUS FD P L2/FIP“
(1 x 2 x0.64 mm², supplier: Lapp) or an equivalent / better cable is suitable.
For usage in severely interference loaded environs a separate shielding might be required.

As connection plug standardized shielded SUB D 9 Profibus connectors are suitable.
The use of connection plugs with integrated (switchable) terminating resistors is recommended.
If the SND40 is placed at the bus end / begin, the terminating resistor must be switched on.

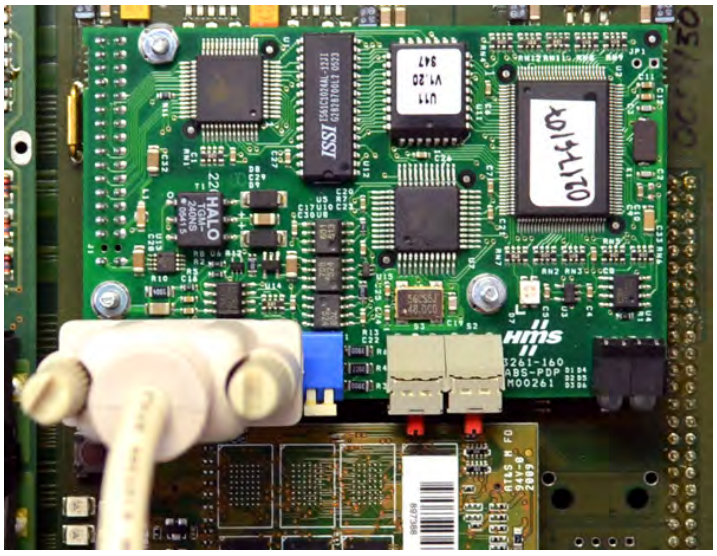


Fig. 22: Profibus module cable

View of module with connected cable		
Allocation of the Profibus plug		
Color of wire	D- SUB	Name
red	Pin 3	P (B-Line)
green	Pin 8	N (A-Line)
Shield	Enclosure	-

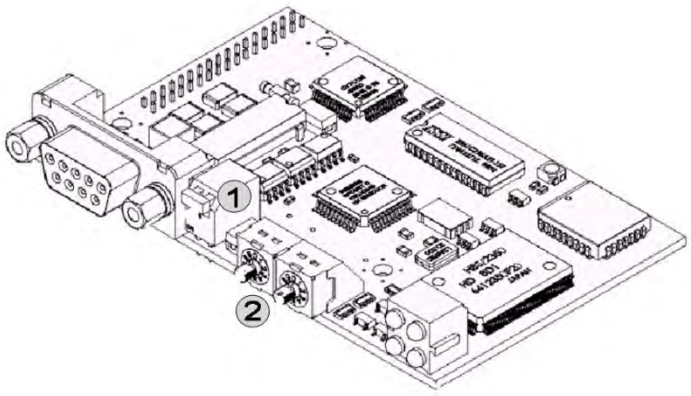
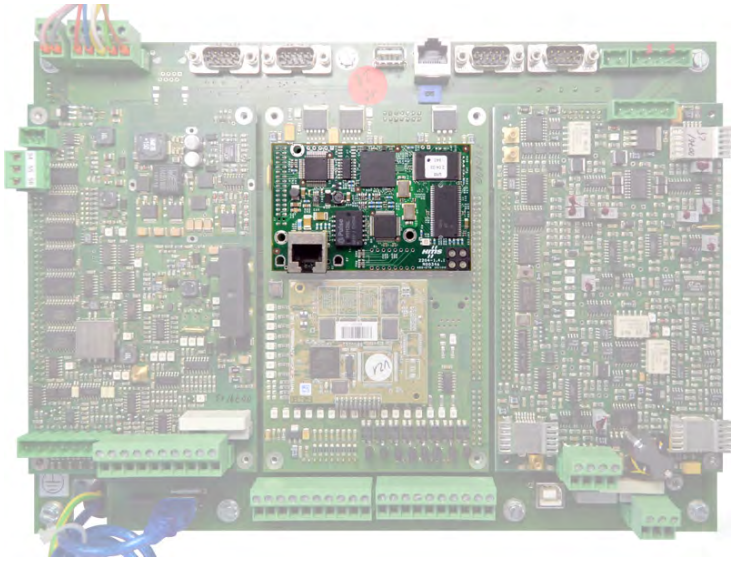


Fig. 23: SND40 Profibus module

Factory setting on Profibus module			
1:	Bus termination		
	downward	=	ON
	upward	=	OFF
2:	Slave address (00) Both turn switches in pos. 0		
	(00) means, the slave address is determined by the system configuration		

4.7.2 ProfiNet IO Connection

A ProfiNet IO module is installed in control units of the type SND40-(EC)-(MF)-PN.
The module is connected to the bus via RJ45 plug.

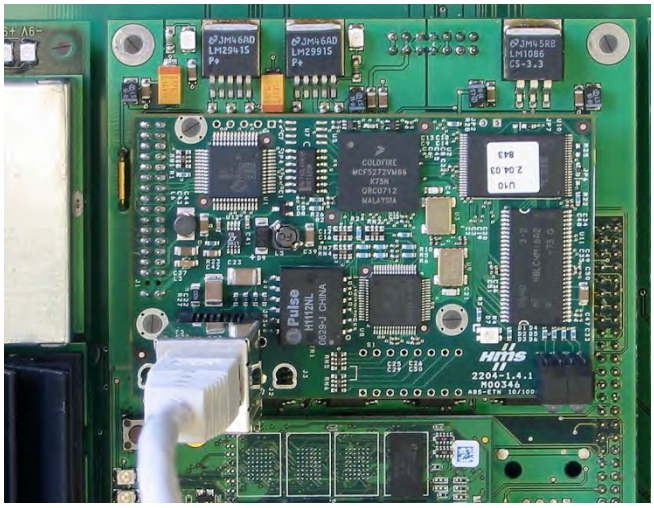


Mainboard SND40
View of ProfiNet IO module (Type Anybus S, supplier HMS Industrial Networks).
For further details on ProfiNet IO interface see chapter ”*Technical data*“.

Fig. 24: SND40 ProfiNet module

Connection to the ProfiNet bus may only be done by an electrician.

Note:
For use as ProfiNet IO cable a commonly used RJ45 Ethernet cable (Cat 5e) is suitable.
For usage in severely interference loaded environs a separate shielding might be required.



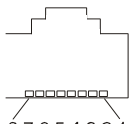
View of module with connected cable		
Allocation of ProfiNet IO socket (RJ45 socket on the p.c.b.)		
 8 7 6 5 4 3 2 1 View: Plug side	Pin 1	TD +
	Pin 2	TD –
	Pin 3	RD +
	Pin 6	RD –
	Pins 4, 5, 7, 8	--

Fig. 25: ProfiNet module cable

Addressing the ProfiNet module

The MAC-ID is hardware determined and cannot be set.
It will be shown in the Hardware info section of the SND40.

The SND40 can be identified at the machine control via this MAC-ID.

5 Communication with the PLC

The PLC can control the SND40 via a Fieldbus interface[1] or a parallel interface.
The following functions can be activated:

- Starting a measurement
- Selecting a program (1… 31)
- Acknowledging and clearing of weld seams
- Resetting of faults

Note:
When using the fieldbus module, error messages can also be read

5.1.1 Signal overview

Inputs (sinking inputs)

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
IN0	BIN0.0	Measurement start / test job start	-
IN1	BIN0.1	Program selection	-
IN2	-	-/(M1)	(…) only possible via parallel interface. Activate by program selection If the program selection is not set, the function mentioned (without brackets) can be activated
IN3	-	-/(M2)	
IN4	-	-/(M4)	
IN5	-	Reset fault 2 / (M8)	
IN6	BIN0.6	Weld Seam acknowledge / (M16)	
IN7	BIN0.7	-	Not used

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
-	BIN1.0 -1.7	-	Not used

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
-	BIN2.0	M1	Program number
-	BIN2.1	M2	
-	BIN2.2	M4	
-	BIN2.3	M8	
-	BIN2.4	M16	
-	BIN2.5-2.7	Not used	-

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
-	BIN3.0 -3.7	-	Not used

[1] Only for control units with integrated fieldbus field bus module
[2] Available starting with software PM version 12

Outputs (sourcing outputs)

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
OUT 0	BIN0.0	Measurement start active / Test job start active	-
OUT 1	BIN0.1	Program selection active	-
OUT 2	BIN0.2	Ready for measuring / (M1)	(…) possible only via parallel interface Active by program selection If the program selection is not set, the function mentioned (without brackets) can be activated
OUT 3	BIN0.3	Set up active / (M2)	
OUT 4	BIN0.4	Slippage/weld seam detected (duration) / (M4)	
OUT 5	BIN0.5	General fault / (M8)	
OUT 6	BIN0.6	Reduced detection capability / (M16)	
OUT 7	BIN0.7	Motor / Weld seam detected (pulse)	-

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
-	BOUT1.0	Ready	-
-	BOUT1.1-1.7	Not used	-

Terminal parallel	Byte.Bit Fieldbus	Name	Comment
-	BOUT2.0	M1	Number of the active program. If no program is active, number 0 will be issued.
-	BOUT2.1	M2	
-	BOUT2.2	M4	
-	BOUT2.2	M8	
-	BOUT2.4	M16	
-	BOUT2.5-2.7	Not used	-
-	BOUT3.0-1.7	Fault identification	See fault reporting table (8-bit)

Fault reporting table

Fault number via bus	Description
10	XY operation interrupted, since the data transfer for display is too slow
11	24 V PLC voltage is missing
12	Flat specimen operation is interrupted, since the data for the display is too slow.
13	Sensor cable broken
14	PLC program number is incorrect e.g. 0
17	Speed measurement not possible
18	Sensor short circuit
19	Leak flux module defect
20	PLC program not implemented
21	Fan defect
80 - 89	Timing problems to the Fieldbus modul (only display no faulty bit)
95	Internal data communication problems RS232
96	Internal problem (incorrect internal instruction)
97	System file not correct
98	Bus module defective

5.1.2 Input "Measurement start / Test job start"

This PLC command causes the SND40 to start a measurement. This function is available via the Fieldbus and the parallel interface. The measurement can be made in the program / operating status **Automatic / Ready** and **Set-up / Edit**.

5.1.3 Input "Program selection"

Via the PLC interface the programs 1 to 31 can be selected binary coded. In addition, the signals M1 to M16 are used.

Pattern for the binary coding		
Program 0	=	Signals M1… M16 not set (this combination is not permitted)
Program 1	=	M1 set
Program 2	=	M2 set
Program 3	=	M1 + M2 set
…	…	…
Program 31	=	M1 + M2 + M4 + M8 + M16 set (control of 1 + 2 + 4 + 8 + 16 = 31)

The program is taken over with the signal “*program selection*”. The program selection fails, if

a) Program No.0 is selected

b) the selected program is missing

c) or the selected program contains inadmissible parameters.

Case a) the failure message "*selected program No. is 0 (invalid)*" is shown, the program will not be switched. Via the bus the fault code 14 is set.

Case b) the failure message "*program parameter index 1 invalid*" is shown, or fault code 20 via the bus. The program switch to the desired program is not executed. The currently active program becomes deactivated. The program number via bus is not changed.

Case c) the failure message "*program parameter index xxx*" is displayed or fault code 20 via the bus. The program switch to the desired program is executed.

Note:

The SND40 has 32 programs in the program memory.
Program 32 cannot be selected, but it can be used as backup memory.

5.1.4 Input “Acknowledge of weld seam”

This function is possible only in the “*flat specimen*” mode. For this purpose the “*acknowledge*” mode has to be switched ON in the system configuration.

In the “*flat specimen*” mode two signals can be evaluated by the PLC:

a) Weld seam detected (impulse)

b) Weld seam detected (duration)

Signal a) is active only as long as a weld seam actually is in front of the sensor. The resulting short impulse can be extended by the SND40[3]. If the PLC evaluates the signal only cyclical (e.g. every 100 milliseconds) the signal may not be reliably detected.

Signal b) should be used then. This signal remains set until the weld seam is cleared.

A stored weld seam signal is only reset by setting the signal "*acknowledge weld seam*".

5.1.5 Input "Reset fault"

With this signal the output "*General fault*“ can be reset. If the fault is serious, the output remains set.

Note:

Faults which repair themselves (e.g. by recovering the SPS voltage) are reset automatically.

5.1.6 Output "Measurement start active"

Indicates that a measurement is active. For this purpose the signal "*measurement start*" has to be applied at the input.

An exception is the set-up operation. Two cases have to be distinguished:

1. **Control test job: PLC**
(Therefore the system parameter "*testjob control mode*" must be adjusted to “*PLC*”).
The operator can request the measurement in the set-up routine by pushbutton. Therefore, the keys <*test job start*> or <*drive*> or (in the X/Y function) the key <*start*> can be used.
The status message "Waiting for PLC start" appears on the display of the SND40 and the signals "Ready for measurement" and "Set-up active" are set. The PLC is now preparing a tube for measurement (prepare tube for measuring and put the sensor on the tube).
When the signal "*measurement start*" is applied at the input, the measurement starts and the output is set.

2. **Control test job: KM**
(Therefore the system parameter "*testjob control mode*" is to be set to “*KM*”)
The operator can start the measurement in the set-up routine by pushbutton. Therefore, the keys <*test job start*> or <*drive*> or (in the X/Y function) the key <*start*> can be used. The measurement starts instantly and the output is set.

Note:

The signal "measurement start " does not have to be applied at the input. Before pressing the <Start> button, the PLC has to prepare a tube for measurement rotation and put the sensor on the tube.

[3] The pulse length can be adjusted with the parameter *" off delay "*.

5.1.7 Output "Program selection active"

Indicates that the program selection has been activated. This signal is not set, if the program is selected via the control panel.

5.1.8 Output "Ready for measuring"

Indicates that the control unit is ready for a measurement, i.e. that a measurement can be started. This is the case if the program -/operating mode is "***automatic/ready***". In the operating mode "***setup / edit***" the signal is set only if the keys <*test job start*>, <*drive*> or in the X/Y function the key <*start*> were confirmed.

5.1.9 Output "Set-up active"

This output is set only in the "*setup / edit*" mode as soon as the keys <*test job start*>, <*drive*> (or in the function X/Y the key <*start*>) have been confirmed.

When the SND40 was configured to "Control test job: PLC", a signal is sent to the PLC for preparing a tube for detection.

When the SND40 was configured to "Control test job: KM", a signal is sent to the PLC for set-up operation.

5.1.10 Output "Slippage/weld seam detected (duration)"

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

Meaning in the *"round specimen"* mode: *"slippage"*.
During the measurement slippage was detected.

Meaning in the *"flat specimen"* mode: "*weld seam detected (duration)*".
A weld seam was detected, but not yet acknowledged. This takes place via the input "*weld seam acknowledge*".

5.1.11 Output "General fault"

In the *"round specimen"* mode this output is set, if either *"slippage"*, *"critical detection"* or a fault are to be displayed.

In the "*flat specimen*" mode this output is set, if a fault is to be displayed.

5.1.12 Output "Reduced detection capability"

In the "*round specimen*" mode this output is set, if *"critical detection"* is to be displayed.

In the "*flat specimen*" mode this output is not used.

5.1.13 Output "Motor / weld seam detected (impulse)"

In the "*round specimen*" mode this output is used for the control of the rotary drive/motor. The output is set, as long as the tube is to be rotated.

In the "*flat specimen*" mode this output is used for reporting of the weld seam detected. The signal is set as long as a weld seam is detected. This time can be extended via the "switch-off delay" parameter (50 ms and 200 mc only)[4].

5.1.14 Output „Ready" via Fieldbus

Output via Fieldbus only. Only set when unit started up without faults.

[4] The pulse length can be adjusted with the parameter *"switch-off delay"*.

5.2 Fieldbus interface

5.2.1 Data transmission

The SND40 with integrated Fieldbus- interface can communicate with a Fieldbus-master. The data transmission communication takes place in cyclic data exchange mode.

For each transmission direction 4 bytes are reserved.

	Data direction	Input		
Master	→	Byte BIN0	Process channel	SND40
	→	Byte BIN1		
	→	Byte BIN2		
	→	Byte BIN3		

	Data direction	Output		
Master	←	Byte BOUT0	Process channel	SND40
	←	Byte BOUT 1		
	←	Byte BOUT 2		
	←	Byte BOUT 3		

Note:

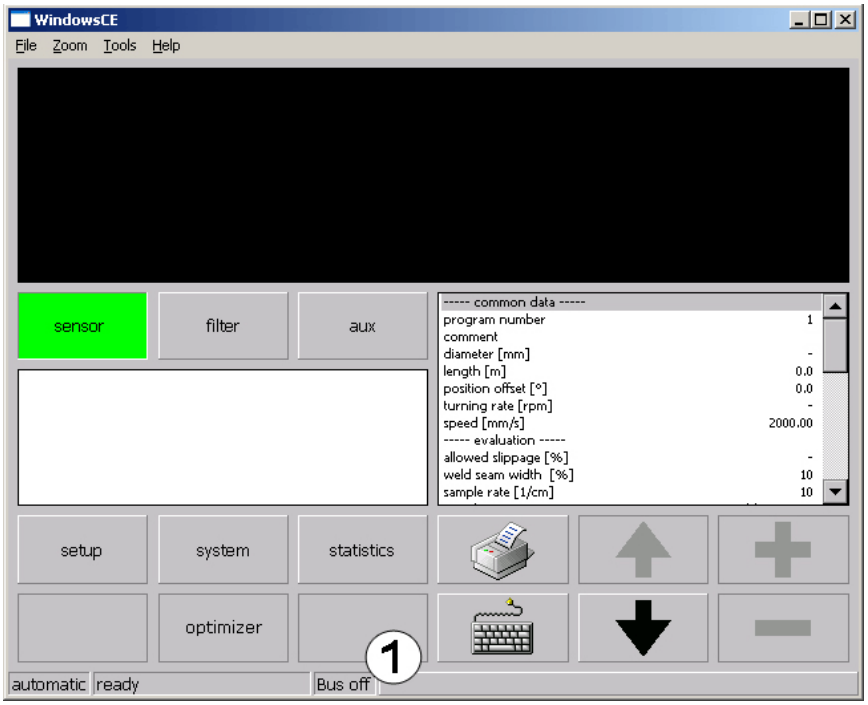
When configuring the data format, attention must be paid to provide consistent data transmission from the PLC.

The allocation of the control signals is described in the signal overview.

The timing behaviour of the control via the bus corresponds with the information provided in the timing diagrams of the parallel interface.

5.2.2 Fieldbus-specific messages

For control units with fieldbus interfaces, the bus messages are displayed after applying supply power.



Description	
1:	Bus message

Fig. 26: SND40 Bus Offline

Overview of bus messages

Message	Explanation	Boundary condition
--	Without Fieldbus-interface	In the system configuration the parameter *"Fieldbus"* is set to OFF
INIT	Phase during the start-up of the control unit; the interface is prepared for operation.	Parameter *"Fieldbus"* is ON and Slave address is valid.
Bus offline	The Fieldbus-interface is in a fault condition or out of order.	Parameter *"Fieldbus"* is ON and Slave address is valid.
Bus online	The Fieldbus-interface is in operation.	Parameter *"Fieldbus* is ON and Slave address is valid.

5.2.3 Bus address

The bus address of the SND40 (Slave address) is assigned in the system configuration with the parameters *"field bus address 1"* and *"field bus address 2"*.

Depending on the type of fieldbus, the valid range of values is different.

Note:
The range of values is not checked by the SND40 during the input.

The fieldbus address (1/2) is stored in the notation 0.0.0.0.

This permits to enter an IP address and a Subnet mask:

Example with Fieldbus interface in the Profibus DP version:

- **Fieldbus address 1**: 0.0.0.123
- (here the address 123 is entered)

Addressing the ProfiNet module

The MAC-ID is hardware preset and cannot be set / changed. It will be displayed in the hardware info of the SND40.

At the machine control the SND40 can be identified by this MAC-ID.

Settings

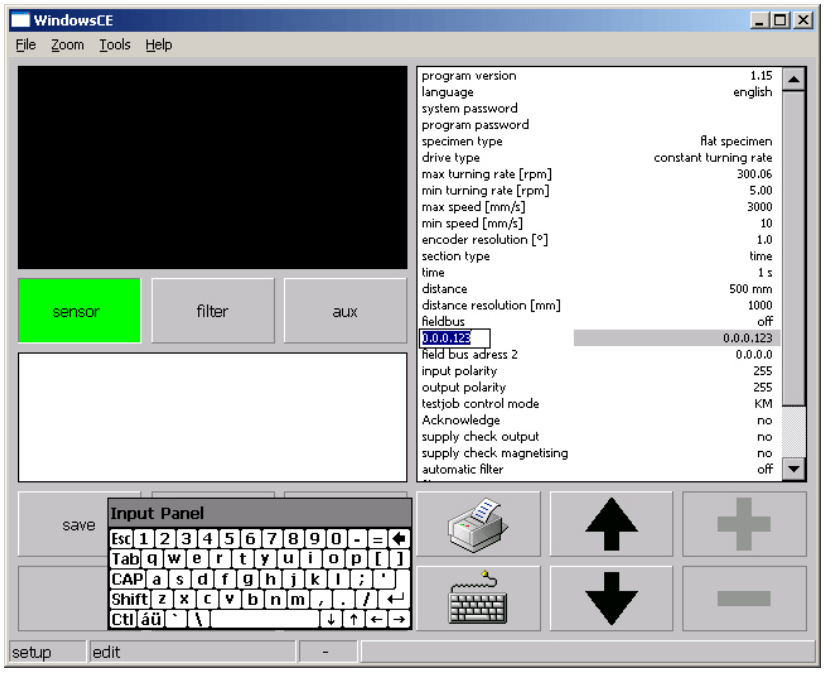


Fig. 27: SND40 Fieldbus address

Description	
1.	Press key < keyboard >
2.	The Onscreen-keyboard (input panel) starts.
3.	Shift keyboard to the left.
4.	Place the cursor with ↑ or ↓ on the parameter *" fieldbus address 1 "* .
5.	The input mode is opened automatically *(visible by the blue background)*

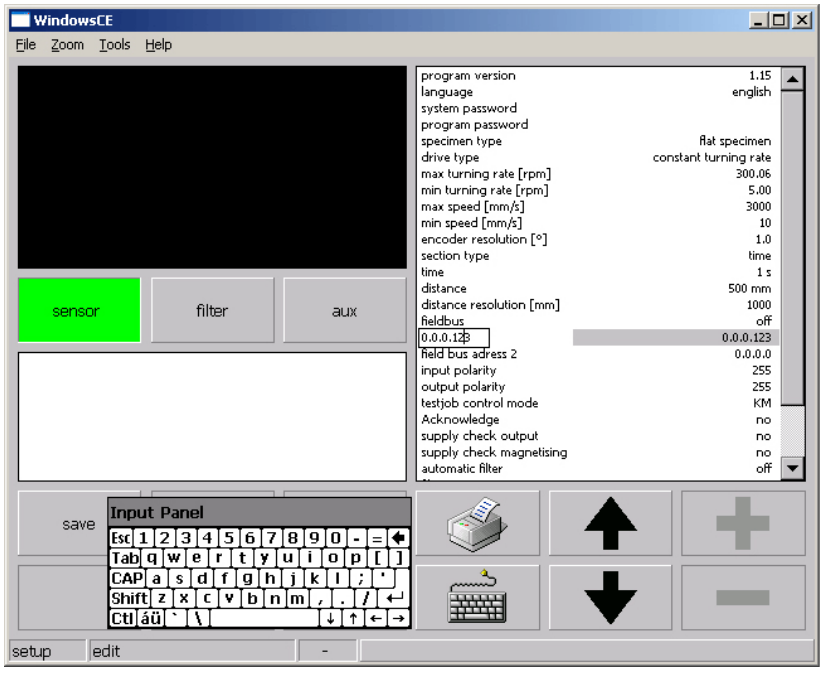


Fig. 28: SND40 Fieldbus address

Description	
1.	Press key ← *(down to the right)* on the keyboard. *(the blue marking disappears)*
2.	Now it is possible to navigate with the keys ← or →.
3.	Enter the address oriented left.
4.	complete the input with the < Return > key.
!	The above items cannot be omitted.

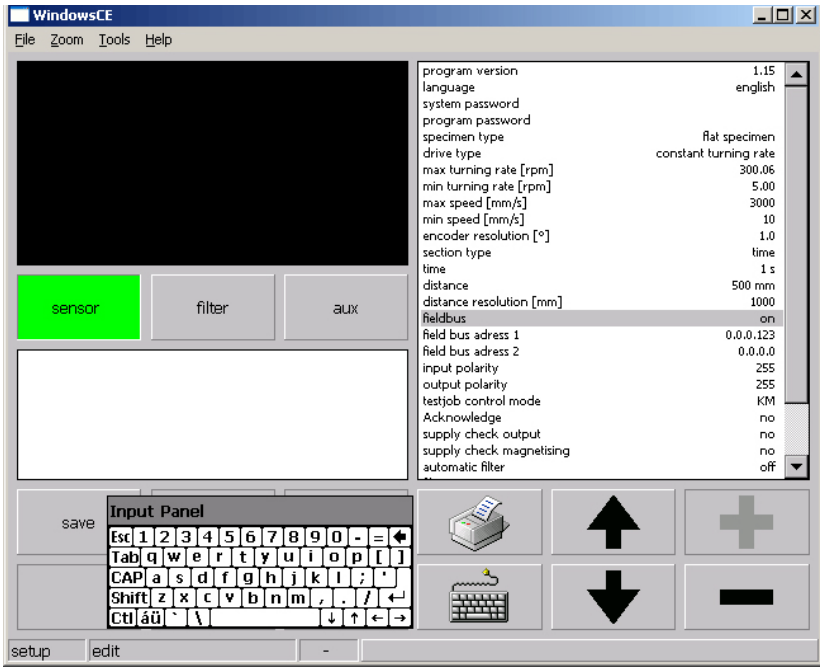


Fig. 29: SND40 Fieldbus On

Description	
1.	Select the parameter *"Fieldbus"* with the ↑ key.
2.	Set the parameter *"Fieldbus"* with the + key to ON
3.	Close the keyboard (input panel) with the < keyboard > key.

5.2.4 GSD file for Profibus

The GSD file contains specific configuration data of the Slaves. The data must be known to the Profibus Master. The manufacturers of the Profibus master supply the tools for integrating the GSD file into the Profibus network. For example, the Siemens “step 7 Tools” are suitable for this. Roland Electronic does not supply such tools, since they must be orientated according to the interface conception of the masters.

The GSD file is supplied on a 3.5" disk or a CD or can be downloaded from the Roland homepage. The file is named "*hms_1003.GSD*".
The contents of the file are shown (in text form) in the chapter
“*Technical information - > Gsd file hms_1003*".

5.2.5 GSD file for ProfiNet IO

The GSD file contains the specific configuration data of the device. The data must be known to the Profibus controller. The manufacturers of the Profibus controller supply the tools for the integration of the GSD file into the Profibus network. Roland Electronic does not supply such tools, because they have to be compatible with the interface design of the controller.

The GSD file is supplied on a CD or can be downloaded from the Roland homepage.
The file has the name "GSDML-V1.0-Hms-ABSPRT-20070221.xml".

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6 Start-up

6.1 Prerequisites for Start-up

The following form helps to clarify whether the SND40 can be put into operation. This is the case if all items can be checked out with YES.

Item	YES	NO
For sensor type EC9...,NS9-EC... and NS9SC: Sensor with rubber buffers mounted and alignment checked [5]		
All other sensor types: Sensor mounted, alignment and distance checked [6]		
Line-up facility for sensor is functional		
For sensor type EC9...,NS9-EC... and NS9SC: Support roller block is mounted and aligned. For encircling coil sensor system: Material guide (if any) is mounted and functional.		
SND40 is mounted		
Power supply for SND40 is connected and checked for function		
Sensor cable is laid out, connected and checked		
PLC interface is connected and checked for function (LEDs)		
PLC is programmed (teach-in and Auto operation) and checked for function		
Material transport is running in Auto mode as well as in Teach-in mode		
Suitable material is available for tests		
Machine can be operated in Auto mode as well as in Teach-in mode at the day of Start-up		
Operator and maintenance staff is ready for training		

[5] When the sensor is contacting the material, all rollers are turning if the tube rotates

[6] Marking for adjusting the sensor aligns with the weld seam. If the tube rotates, the distance remains constant and smaller than the maximum stated in the data sheet

6.2 Menu tree

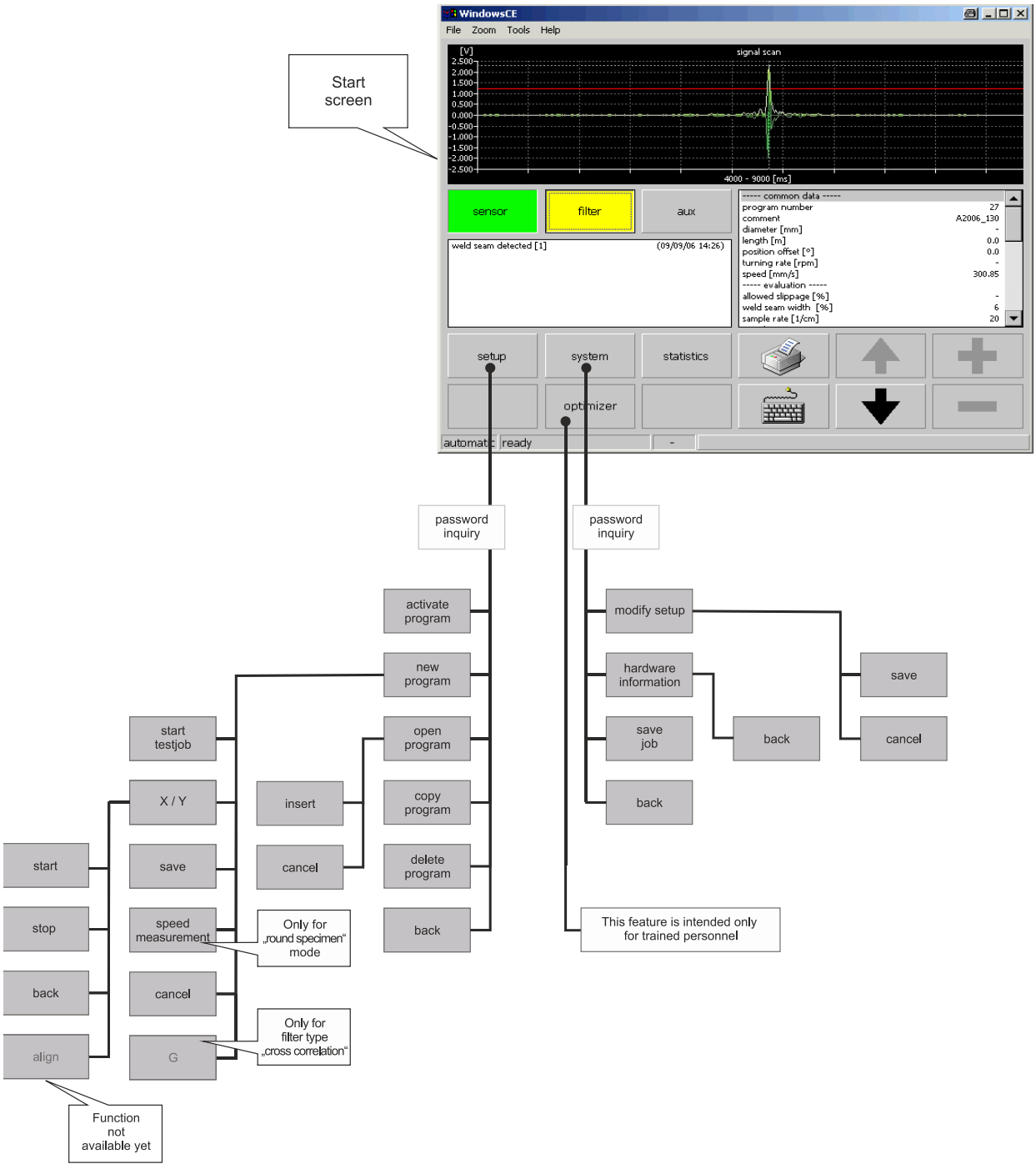

Fig. 30: SND40Menu tree

6.3 Basic settings / Standard values

6.3.1 Program parameters

Standard values – Eddy current

Parameter	**Standard value**	Alternative	Application-specific	Standard
General data				
Program number:	**1**			X
Comment:			X	
Diameter [mm]:	**-**			
Length [m]:	**0**			
Position offset [°]:	**0**			
Rotation rate [rpm]:	**-**			
Speed [mm/s]:	**1000**		X	(X)
Evaluation				
Slippage [%]	**-**			
Weld seam width [%]:	**5**			
Sample rate (1/cm):	**30**		(X)	X
Sensor signal:	**Eddy current**			X
Digital filter type:	**absolute**	pos./neg.	(X)	X
Detection grade:	**-**			
Group:	**-**			
Correlation factor:	**-**			
Eddy current parameters				
Low pass [Hz]:	**1000**		(X)	(X)
High pass [Hz]:	**1**		(X)	(X)
Frequency [kHz]:	**50.0**		(X)	(X)
Phase [°]:	**0**		X	
Signal type:	**Y-component**	Amplitude[7]	(X)	(X)
AC gain [dB]:	**20**		(X)	
Output AC level [V]:	**20**			X
DC s offset [mV]:	**-**			X
Y zoom:	**1**			X
Signal parameters				
DC gain:	**20**		(X)	X
Magnetisation				
Magnetising level [%]:	**100**		(X)	X
Settling time [ms]:	**1500**			X
Switch-off delay [ms]:	**0**			X
Indication parameters				
Scan sections:	**5**			X

[7] Do not use for applications with speeds larger than 2000mm/s

Standard values - Leakage flux

Parameter	**Standard value**	Alternative	Application-specific	Standard
General data				
Program number:				X
Comment:			X	
Diameter [mm]:	**-**			
Length [m]:	**0**			
Position offset [°]:	**0**			
Rotation rate [rpm]:	**-**			
Speed [mm/s]:	**1000**		X	(X)
Evaluation				
Slippage [%]	**-**			
Weld seam width [%]:	**5**			
Sample rate (1/cm):	**30**		(X)	X
Sensor signal:	**Leakage flux**			X
Digital filter type:	**Absolute**	pos./neg.	(X)	X
Detection grade:	**-**			
Group:	**-**			
Correlation factor:	**-**			
Eddy current parameters				
Low pass [Hz]:	**1000**			
High pass [Hz]:	**1**			
Frequency [kHz]:	**50.0**			
Phase [°]:	**0**			
Signal type:	**Y component**			
AC gain [dB]:	**20**			
Output AC level [V]:	**20**			
DC s offset [mV]:	**-**			
Y zoom:	**1**			
Signal parameters				
DC gain:	**1**		(X)	X
Magnetisation				
Magnetising level [%]:	**100**		(X)	X
Settling time [ms]:	**1500**			X
Switch-off delay [ms]:	**0**			X
Indication parameters				
Scan sections:	**5**			X

6.3.2 System parameters

Standard values – Eddy current / Leak flux

Parameter	Eddy current		Leakage flux	
	Standard value	Alternative	**Standard value**	Alternative
Program version:				
Language:				
Product geometry:	**Flat material**		**Flat material**	
Driving principle:	**Speed constant**		**Speed constant**	
Max. rotation rate [rpm]:	**300.06**		**300.06**	
Min. rotation rate [rpm]:	**5.00**		**5.00**	
Max. speed [mm/s]:	**5000**[8]		**5000**	
Min. speed [mm/s]:	**10**		**10**	
Angular resolution [°]:	**1.0**		**1.0**	
Interval forming:	**Time**		**Time**	
Time interval:	**5 s**		**5 s**	
Path interval:	**500 mm**		**500 mm**	
Path resolution [mm]:	**1000**		**1000**	
Fieldbus:	**off**		**off**	
Fieldbus address 1:	**0.0.0.0**		**0.0.0.0**	
Fieldbus address 2:	**0.0.0.0**		**0.0.0.0**	
Inputs to logics:	**255**		**255**	
Outputs from logics:	**255**		**255**	
Selection test job:	**KM**	PLC	**KM**	PLC
Confirm mode:	**no**	yes	**no**	yes
Monitoring of outputs:	**yes**	no	**yes**	no
Monitoring of magnetizing current	**yes**	no	**yes**	no
Filter automatics:	**off**	on	**off**	on
Filter parameters:	**5**		**5**	
Effective width of probe [mm]:	**4**		**4**	
Monitoring of slip:	**off**	on	**off**	on
Statistics:	**off**	on	**off**	on

[8] For encircling coil systems and eddy current probes the value can be set to 15000.

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7 Operation

7.1 Switching on and Powering up

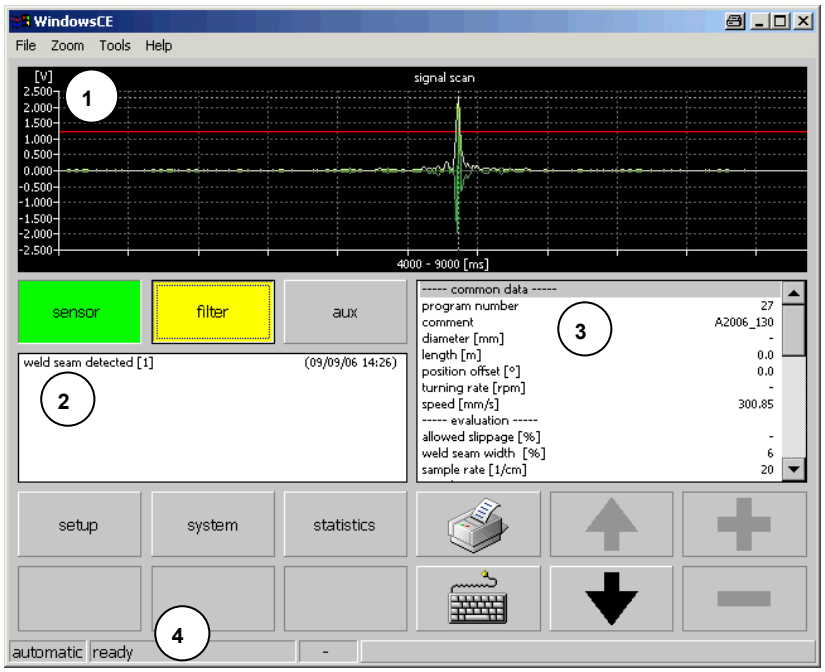
The system will be switched on by applying mains power. The operating software will then automatically be loaded. This procedure can require up to 30 seconds.

While the operating software becomes loaded, the system will check the voltages, cables and sensors. If a fault condition is detected here, the system will show respective messages.

Has the operating software been loaded, the system automatically switches over to the measurement mode and loads the last used measurement program. If another measurement program is to be used, the operator must change over to the program list (with the <SETUP> key) and choose a suitable program.

7.1.1 Measuring operation

After powering up, the system automatically switches over to the measuring operation.



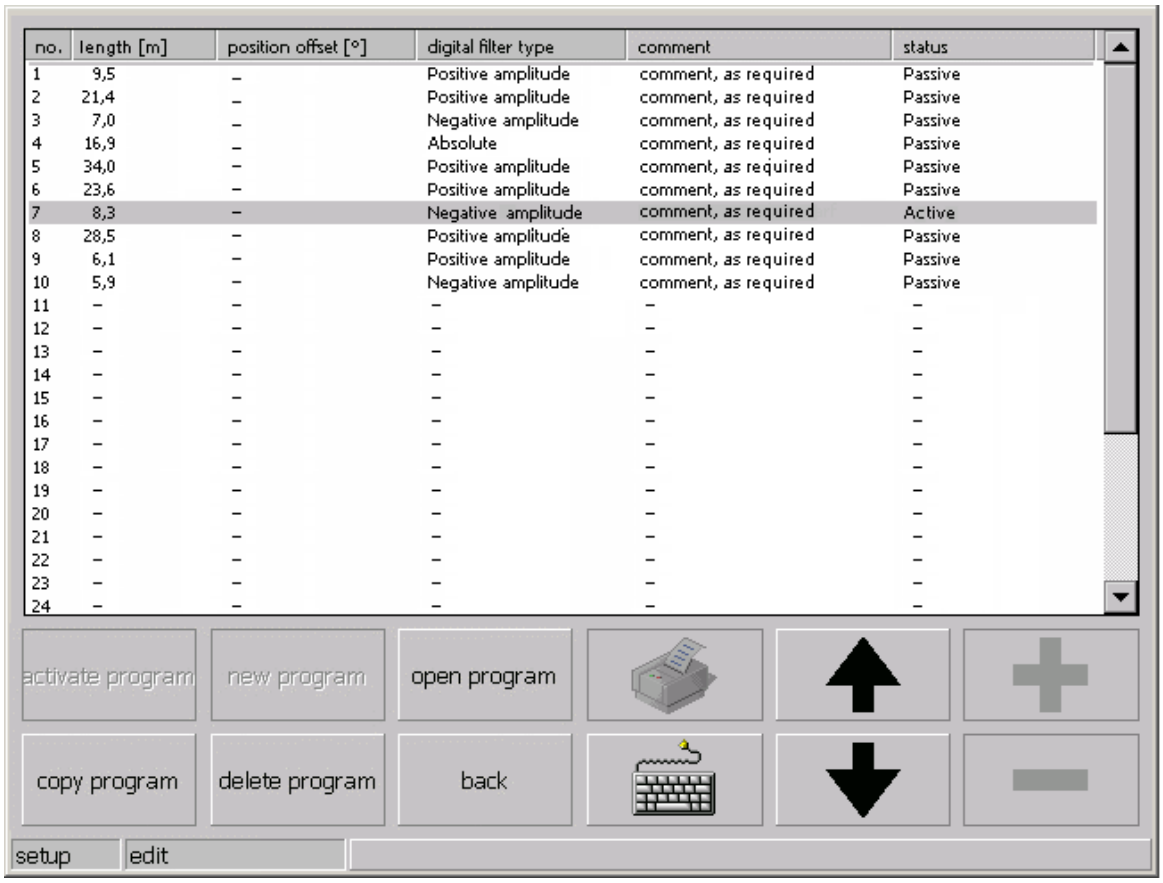
Screen area	
1:	Visualization of the sensor signal (original signal und digitally filtered signal) and a control signal.
2:	List of measuring results.
3:	List of parameters of the activated measuring program.
4:	Indication of program status and operation condition, see chapter ”*Maintenance and repair*“.

Programm	Changes over to the program selection.
System	Changes over to the system parameter selection.
Statistik	Changes over to the statistics function.

	Prints out the signal visualization and a list of the program parameters.
	No key function in this mode.
	Selects the parameters from the list.
	No key function in this mode.

7.2 Teach-in – Program selection

Administrating the measuring programs.

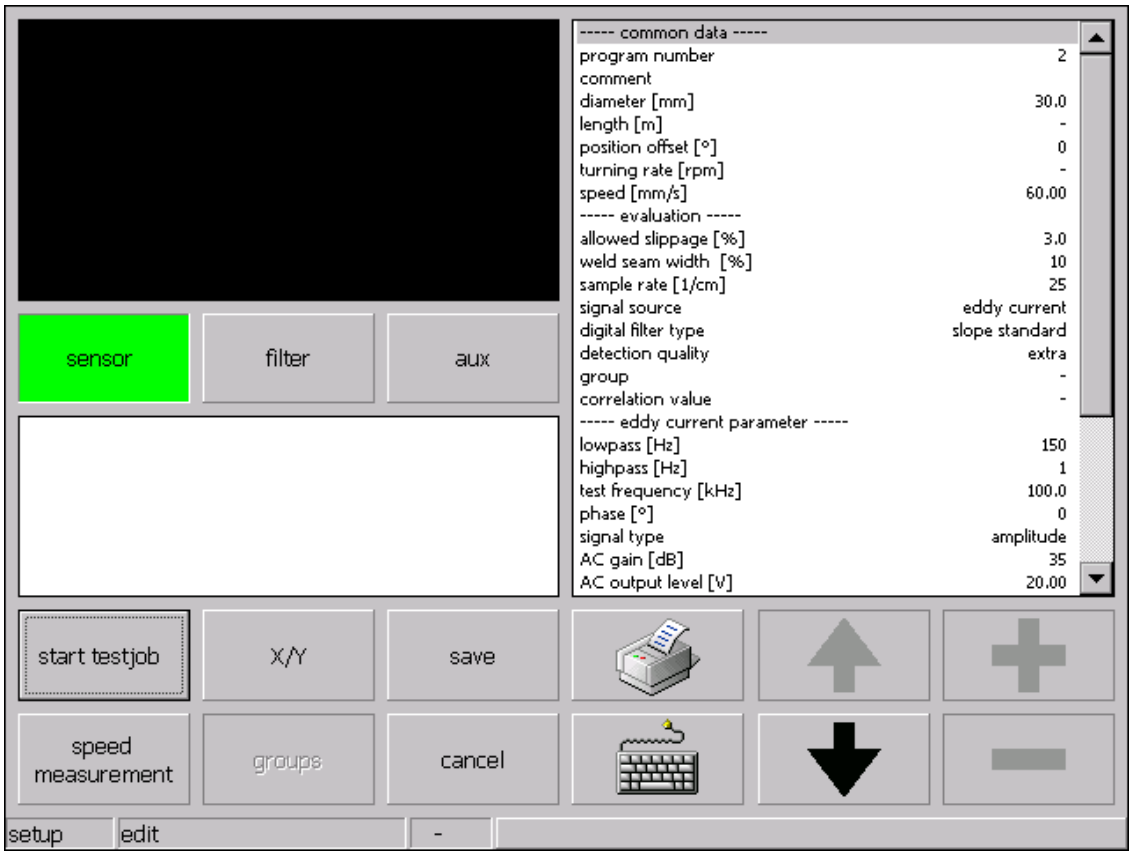


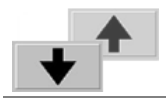
Programm aktivieren	Switches this program active, on which the cursor is just placed. The currently active program will be switched passive.		Prints out the program list.
Programm neu anlegen	Sets up a new program at the empty program space, on which the cursor is just placed. Therefor the unit switches over to the mode “Teach-in Test operation”.		No key function in this mode.
Programm bearbeiten	The unit switches over to the mode “Teach-in Test operation“.		Selects the parameters from the list.
Programm löschen	Deletes the program, on which the cursor is just placed.		No key function in this mode.
Programm kopieren	Copies the program, on which the cursor is just placed on, into the clipboard. For storing this program onto another program place, select an empty program place and press the “Insert” key.		

The parameter ”Length“ can be used for identification.
The value itself has no influence on the system.

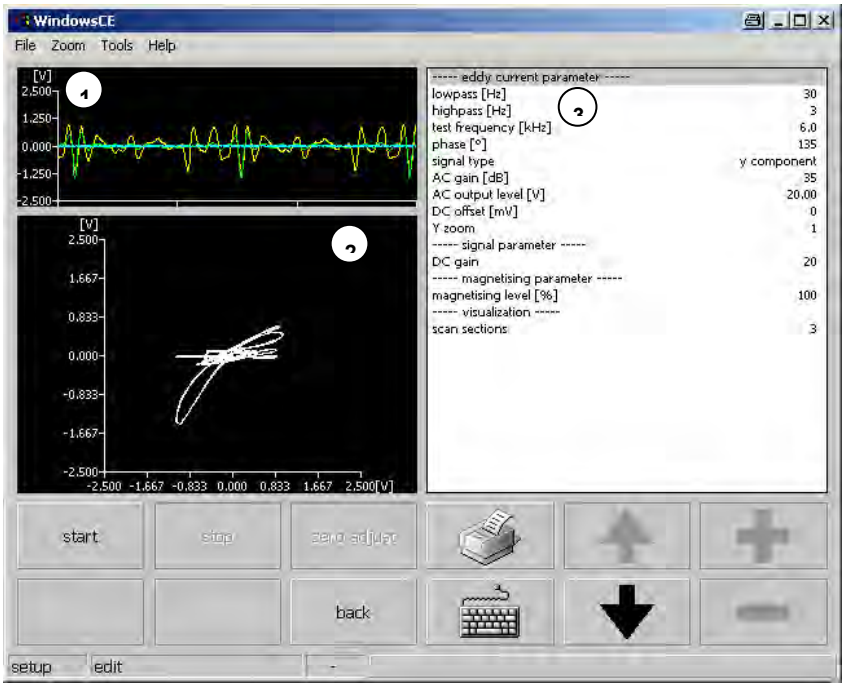
7.3 Teach-In – Test operation

The screen contains the same functions as shown in the measuring mode. However, the size of the signalling is reduced in favour of the parameter list.



Testjob starten	Starts a positioning.		Prints out the program list.
X/Y	Changes (on signal type “*Eddy current*”) to the mode ”*Teach-in – X-Y-diagnosis*”.		Inserts the screen keyboard.
Speichern	Stores the unit settings and returns to the mode ”*Teach-in – Program selection*”.		Enters the parameter.
Antrieb	Starts measuring the turn speed.		Selects the program parameter from the list.
Abbrechen	Returns to the mode ”*Teach-in – Program selection*” without storing the program parameters.		Changes the program parameter.

7.4 Setup X/Y diagnosis



Screen area	
1:	Indication of the X and Y signals and the control signal vs. time.
2:	2-dimensional indication of the signals of the eddy current sensor.
3:	Indication of all parameters of the eddy current channel and parameters for controlling the X/Y visualization.

Fig. 31: Setup X/Y diagnosis

start	Starts the continuous measuring operation. (Signals see chapter 11.1 timing diagram x/y with test job PLC or test job KM)
stop	Stops the continuous measuring operation.
back	Changes over to the ”setup operation“ mode.

	Prints out the signal visualization and the eddy current parameters.
	No key function in this mode.
	Selects the parameters from the list.
	Changes the program parameters.

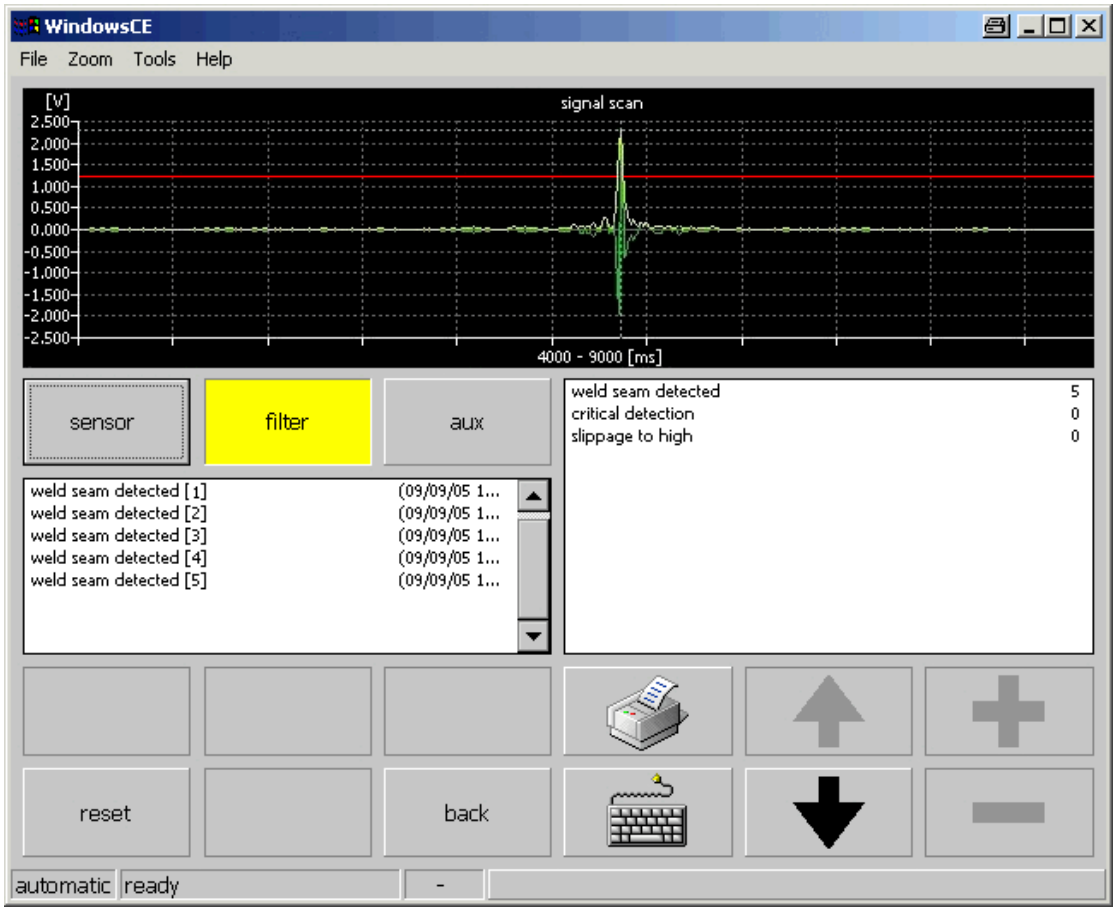
X-share of signal: yellow line.
Y- share of signal: green line.

7.5 Statistics function

Evaluation of detection results.

In the *„Flat specimen“* mode this function should generally remain deactivated (set system parameter *„Statistics“* und *„Create SN file“* to *„off“*) and only be activated if required.

At the left side the events are shown in the rank of appearance, at the right side the accumulation of events since the last reset.



	Resets the event table.		Prints out the signal progression and the parameter list.
	Exits the statistics function.		No key function in this mode.
			No key function in this mode.
			No key function in this mode.

- Setting the “*Statistics*“ system parameter to ”*on*” activates the statistics function.
- Setting the “*Create SN file*“ system parameter to ”*on*” activates storing the statistics values in a log book file.

7.5.1 Generating Log files

The system can generate 3 different Log files:

1. Statistics.log

Generating this file can be switched on with system parameter <*Statistics on/off*>.

Example:

```
[STATISTICS]
GOOD = 148634
BAD = 552
SLIPPAGE = 168
[PROGRAM]
ACTIVE PROGRAM = 2
[ERROR]
CURRENT_POSITION = 17
ERROR1 = 0X00C
ERROR2 = 0X00C
ERROR3 = 0X00C
```

2. SNlog.1234

Generating this file can be switched on with system parameter <*SN file on/off*>

The file extension encrypts the current date (year*365 + month*31 + day). After 14 days the oldest file will automatically be deleted. (Statement of signal-noise-ratio from SND version 1.17)

Here all messages are stored, which are shown in the status bar.

Example:

```
Weld seam detection good  14dB     10/04/07   09:47
Weld seam detection good  12dB     10/04/07   09:48
PM: AC overdrive     10/04/07   09:48
Weld seam detection not possible  0.9dB     10/04/07   09:49
...
```

3. Signal1.log

Shows the digital values of the measured tubes.

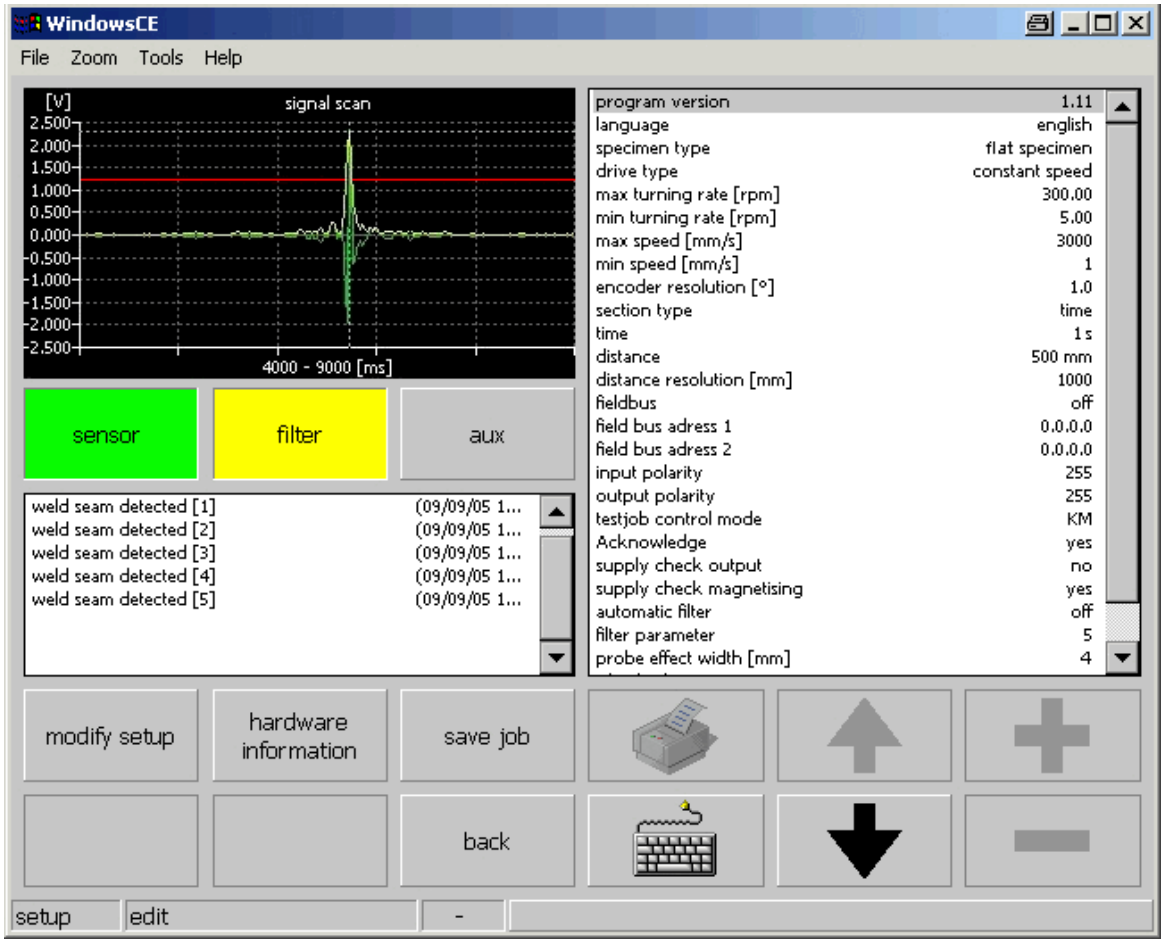
The file can be accessed with keys <*System*> <store *Job*>. There will be max. 10 files generated, then the first file will be overwritten.

Example:

```
ProgNo 4, 14/02/07 23:53
Weld seam detection not possible 0.9dB      (inserted from SND version 1.17)
Original, Filter, Check
2503, 382, -83
1722, 180, -47
2424, 358, -61
1448, 127, -67
654, 26, -34
-1646, 165, -49
-1742, 185, -7
```

7.6 System Parameters

Setting the system parameters.



Einstellungen ändern	Changes the current parameter settings.		Prints out the signal progression and al list of the eddy current parameters.
Hardwareinfo	Shows the hardware parameters.		No key function in this mode.
Job speichern	Stores the data of the last measurments [signal1.log].		Selects the parameters from the list.
Zurück	Returns to the measuring mode.		No key function in this mode.

7.6.1 Modifying of system parameters

If system parameters need to be changed, proceed as follows:

- Press the <*System*> key when being in the measurement mode.
- Press the <*modify setup*> key.
- If a password is existing, the password inquiry appears.
  Then type-in the valid password and confirm with <Enter>. Only then access to the system settings is permitted.
  If no password is existing, the password inquiry will not be called up.
- With the <*arrow*> keys access the entry to be changed from the parameter list to the right and change with the <+> / <-> keys.
- With the <*save*> key store the entry or dismiss with <*cancel*>.
- If a restart is required, the system will perform it automatically (systems following serial number 400059 / SW version 1.16).

It is recommended to note down all changes, in order to enable easy return to the previous settings in case of doubt.

7.7 Creating and editing of measuring programs

In the measuring programs the parameters for detecting and positioning the weld seam are stored.

We recommend to create product specific / tool specific measuring programs, in order to consider all variables (material, wall thickness, width of weld seam, etc.) which are important for optimal detection.

For creating / editing a measuring program first insert a sample tube into the turn drive and with the <*Program*> key change over to the ”*Setup – program selection*” mode. There select an empty program place or the program to be edited.

Note:

If measuring programs already exist and the program to be newly set up is determined for similar material, then the setting up procedure for the new program can be simplified by copying an existing program and then modifying it.

1. With the key <*Edit program*> change over to the ”*Setup – test operation*“.
2. Enter parameter ”*Description*“ (only for initial editing).
3. Enter parameter ”*Speed*“ (max. value).
4. Enter parameter “*Sensor signal*“:
   When using the sensors NS9SC, select “*Leakage flux*”;
   when using the sensors NS9-EC… select ”*Leakage current*“ or “*Eddy current*”;
   when using the sensors EC… select “*Eddy current*”.
5. Press the <*Speed measurement*> key:
   The system is now ready for measurement. If the material is moved

- continue on the next page -

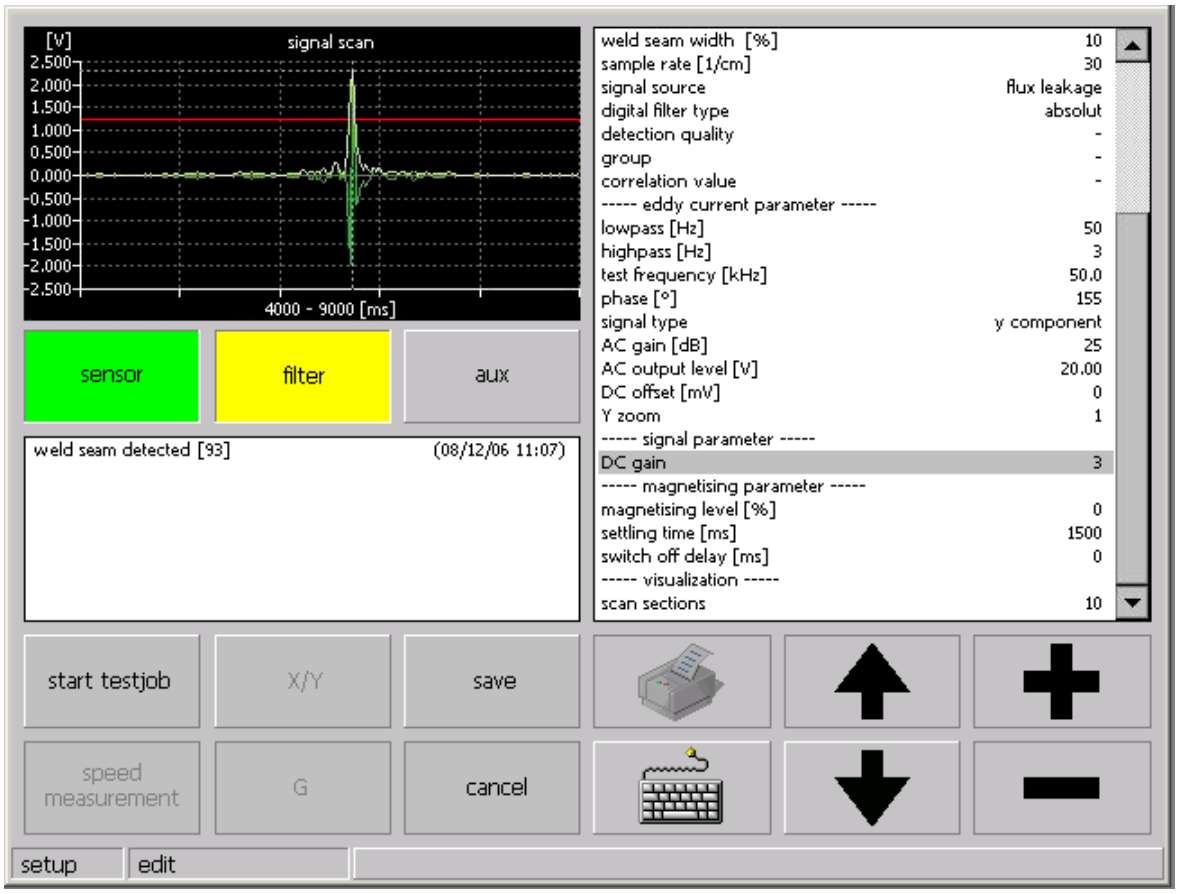


Fig. 32: SND40 creating and editing of measuring programs

6. Press the <*Start test job*> key. If the seam signal does not exceed the switching threshold of 1.25 V (visible as red line), the signal gain must be increased.
7. For doing so, select the AC Gain parameter with the arrow keys and increase the gain value. The degree of increasing depends on the current signal level. If the signal level is e.g. 0.5 V, the signal gain should be increased by factor 5. Check the result of this change needs to be checked in a second test run.
8. Press the <*Start test job*> key.
9. Again run the material with the sample weld seam and repeat steps 6…8, until the switching threshold will be exceeded by at least 0.5 V.
10. If the weld seam safely exceeds the switching threshold, check in any case if the gain can be further increased. Therefore the material must be run without weld seam. The level of the noise signal (material without weld seam) should be far enough away from the switching threshold, it should not be more than 0.75 V. The higher the gain can be set, the lower is the danger that a seam will not be detected[9].
11. If required, repeat the test run (with sample seam) with min. and max. speed, the seam should always be detected.
12. Leave the "*Setup – test operation*" mode and store the parameters with the <*Store*> key.
13. Activate the created measurement program with the <*Activate program*> key.
14. Go back to the automatic operation mode with the <*Back*> key.

[9] The risk of creating mis-triggering events also rises.

7.8 Optimizing the positioning of the Weld seam

If no satisfying results can be achieved with the default settings, the changing of certain parameters can often cause improvements.

For more details see section “General parameters” and “Special parameters for sensor signal “Eddy current””.

7.9 Setting-up and changing the system / program password

The passwords for system parameters and program parameters are changed in the same manner.

When entering the password, the system distinguishes between capital letters and regular letters!

1. Press the <*System*> key and then the <*modify setup*> key.
2. If a password is already existing, the password inquiry will appear. Then type-in the current password and confirm with <Enter>. Only then access to the system settings is permitted.
   If no password is existing, the password inquiry will not be called up.
3. Activate the <*Onscreen keyboard*>.
4. With the <*Arrow*> keys select the “*system password*” resp. the “*program password*”.
5. Enter the new password.
6. With the <*Save*> key confirm the entry.
7. If re-starting is required, the system performs it self-acting.

7.10 General parameters

Parameter:	*„Speed [mm/s]“*
Standard value:	1000
Value range:	1 - …

This value states the speed (in mm/s) of the material passing the sensor, the expected max. material speed must be set here.

The maximal speed at which the SND40 can measure, depends on the following relation:

$$10 < V < \frac{K}{A}$$

V = Speed (mm/s)
A = Sample rate per cm
(Setting in program parameter)
K = 50.000

Example: A = Sample rate per cm: 7
K = 50.000
resulting: 10 < V < 7.140,
i.e. at the supposed sample rate of 7,
the max. material speed V may be 7.140 mm/s.

Parameter:	*„Samples per cm“*
Standard value:	30
Value range:	1 - …

This value states the number of samples per cm of material passing the sensor.

For a secured measurement result, at least 3 samples per weld seam are required.

Thus, the sample rate must be set such that within the weld seam width at least 3 measurements are performed.

Example: For a weld seam width of 5 mm a scan width of approx. 1.5 mm results for 3 scans within this 5 mm weld seam, thus a value of 7 scans per cm results.

Parameter:	*"Filter type"*	The SND40 filters the signal digital. The result (yellow signal) will be recruited for detecting the weld seam. The filter type "absolute" will rectify the sensor signal. Thus the positive and the negative shares of the signal will be considered. The filter types "positive/negative amplitude" will consider only the positive resp. Negative signal share. Those both filters are intended for the following task: Two different materials are united, and the direction of material rank is to be evaluated.
Standard value:	Absolute / Positive amplitude / Negative amplitude	
Value range:	-	

Parameter:	*"Settling time"*	The settling time is the time which is required for setting up the magnetic field. It is only required for using sensors with electro magnet and ferro magnetical material. The following basic value applies for NS9 sensors: 500ms/mm wall thickness. Important: The measurement will start after this time. For EC sensors this value can be set to 0.
Standard value:	1500 ms	
Value range:	0- 5000ms	

Parameter:	*"Signal gain"*	Increases the signal amplitude, so that the weld seam signals will reach the switching threshold. For leakage flux the values typically are between 1...5, for Eddy current between 10....100.
Standard value:	1	
Value range:	1 - 100	

7.11 Special parameters for sensor signal „Eddy current"

Parameter:	*"Low pass"*	Reducing the value improves the signal quality under influence of RF interferences (e.g. frequency converters, annealing facilities).
Standard value:	1000	
Value range:	-	

Parameter:	*"High pass"*	Enlarging the value improves the signal quality under influence of LF interferences (e.g. variations of distance due to insufficient sensor holders or uneven tubes).
Standard value:	1	
Value range:	-	

Parameter:	*"Frequency"*	Enlarging the value improves the detection of weld seam characteristics at the exterior surface of the material (e.g. jutting-out of seam at outside). Reducing the value improves the detection of weld seam characteristics in the deeper areas of material. Changing the frequency normally requires adaptation of the parameters *"Phase"* and *"Input gain"*. For most applications a value of 25 - 100 kHz is optimal.
Standard value:	50 KHz	
Value range:	1 - 1000 kHz	

Parameter:	*"Phase"*	Changing the value turns the eddy current signal at the X/Y level, it is used for optimizing the signal on use of the signal type "*Y Component*"
Standard value:	none	
Value range:	0 - 359°	

Parameter:	*"Signal type"*	On analysing the amount, the eddy current signals are evaluated independently from their phase position (X/Y indication). This setting should only be used for very pithy weld seam signals with a weld seam detection not affected by noise signals. The usage of the Y Component setting can often improve the signal quality. Therefore, the parameter "*Phase*" must be set accordingly. Important: The "Amplitude" signal type must not be used for material speeds larger than 2m/s.
Standard value:	Y Component	
Value range:	Amplitude, Y Component	

Parameter:	*"Input gain"*	Increasing the value can result in better signal quality, but also in overdriving the input stage. When changing the frequency, this parameter must be adjusted.
Standard value:	20 dB	
Value range:	20 dB - ...	

Parameter:	"*Output AC voltage*"	This value should only be changed in exceptional cases. Decreasing the value will decrease the sender signal and thus attenuate the sensor signal.
Standard value:	20 V	
Value range:	0 - 20 V	

Parameter:	*"DC Voltage offset [mV]"*	This parameter should not be changed.
Standard value:	0	
Value range:		

Parameter:	*"Rel. Magnet flux [%]"*	Changing the value causes stronger / weaker magnetization of the material being in front of the sensor. Changing the value can result in better signal quality and requires adjustment of the parameter "*Phase"* on use of the signal type *"Y Component"*. When using the EC-…-sensors, this value should be 0%. When using the NS9SC… and NS9-EC… sensors, this value should be 100%.
Standard value:	100 %	
Value range:	0 - 100 %	

7.12 Setup – Test operation X/Y

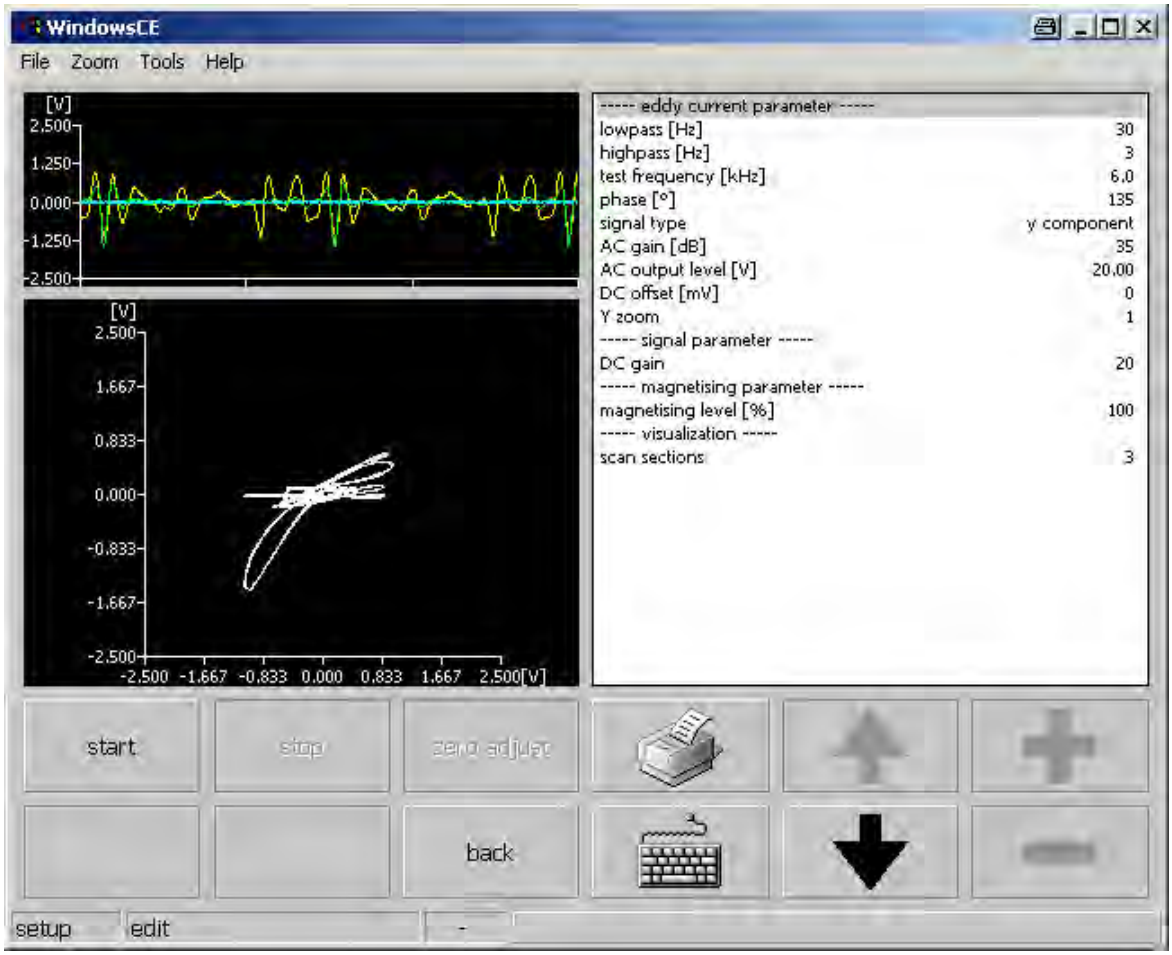


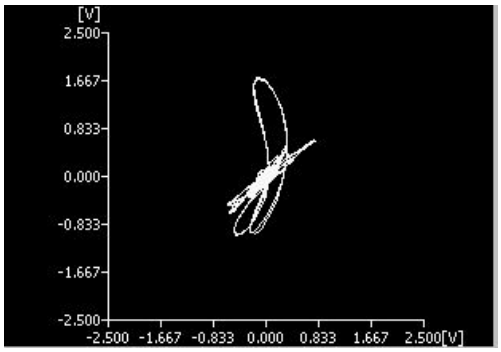
Fig. 33: Setup the test operation

The function “X/Y“ serves for checking and optimizing the program parameter settings (on signal type “*eddy current*“).

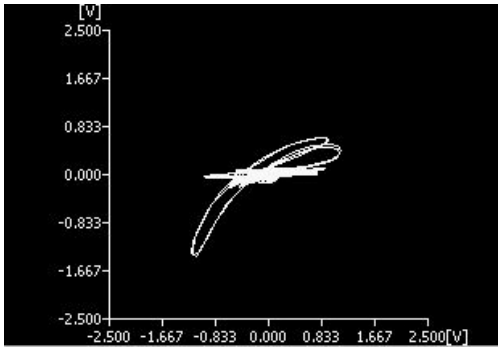
In this mode the signal is shown two-dimensionally. At the signal type “*Y Component*” only the vertical signal share is considered.

X-share of signal: yellow line.
Y- share of signal: green line.

The signal display is in this mode two dimensional. The signal type "Y component" is evaluated only by its vertical signal component.
Therefore the signal of the weld seam regularly is aligned vertically with the parameter "*Phase*".



In the shown case further improvement can be reached by setting the parameter "*Phase*" differently. The "noise" signal (which does not belong to the weld seam) becomes horizontally oriented:



Though now not the full amplitude of the weld seam signal becomes evaluated, the signal-to-noise ratio is remarkably better and thus the positioning is more safely.

With the following parameters the X/Y indication and the X/Y gains can be controlled:

Parameter:	"*Scan sections*"	This parameter sets the storage time for the display. The length of the picture intervals is set in the system parameter list.
Standard value:		
Value range:		

Parameter:	"*Y zoom*"	This parameter sets the gain for the vertical signal shares.
Standard value:	1	
Value range:	1 - …	

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8 Fault messages, causes and remedies

Text of error message	Error No. via Field bus	Possible cause	Remedy
Error while initialization of WIN sockets.	-	Windows system error	Re-install Windows CE
Unknown error.	-	Unspecific error.	Re-start
Invalid data received.	20	Processor module is sending invalid data. Bus connection or hardware might be defective.	Check RS232 connection between processor module and communication module – change hardware.
System configuration was not converted.	-	Invalid values for system settings or memory error.	Check / re-enter parameters, change hardware if required.
File error.	-	File cannot be read or has a wrong format.	Create the program newly.
Internal error.	-	Unspecific error.	Re-start.
Program initialization failed.	-	Error in the program file.	Re-teach.
Frequency table not loaded.	-	Error in the frequency file.	Re-install.
System configuration was not stored.	-	Error in Flash.	Change KM hardware.
System configuration was not loaded.	-	Error in the system file.	Re-enter system parameters or change KM hardware.
Unable to copy program.	-	File already existing, insufficient memory space or error in Flash.	Delete unused files, check name.
Unable to store program.	-	File already existing, insufficient memory space or error in Flash.	Delete unused files, check name.
No active program.	-	No valid program selected.	Select a valid program.
Invalid program number.	-	No valid program selected.	
Program parameter xxx invalid. xxx = no. of parameter (see rank in program file).	20	Special parameter is invalid.	Re-enter parameter.
System parameter xxx invalid. xxx = no. of parameter (see rank in system file).	-	Special parameter is invalid.	Re-enter parameter.
Parameter xxx in system settings invalid. Please modify and restart system. xxx = designation of parameter, e.g. “Language”.	-	Special parameter is invalid.	Re-enter parameter.
Unable to save job.	-	File already existing, insufficient memory space or error in Flash.	Delete unused files, check name.
Invalid groups.	20	Data quantity of groups (auto correlation) does not match.	Delete program, re-teach.
PM: receive buffer overflow.	95	Too much data to proc. module.	Check RS232 connection / Hardware error.
PM: character not in hex format.		Error at data transmission.	
PM: message error - no STX.		Error at data transmission.	
PM: message – checksum wrong		Error at data transmission.	

Text of error message	Error No. via Field bus	Possible cause	Remedy
Invalid groups.	20	Data quantity of groups (auto correlation) does not match.	Delete program, re-teach.
PM: receive buffer overflow.	95	Too much data towards processor module.	Check RS232 connection / Hardware error.
System error.	95	System error.	Re-start / Hardware error
PM: message error - no STX.	95	Error at data transmission.	Check RS232 connection / Hardware error.
PM: char not received in hex.	95	Error at data transmission.	Check RS232 connection / Hardware error.
PM: message checksum error.			
PM: message ID not in hex.			
PM: message length invalid.			
PM: unknown message ID.			
PM: unexpected message.			
PM: XY data transfer to slow.	10	Data speed too high in x-y operation, or manual entries during measuring.	Possible due to system, Re-start function. Refrain from entering during measuring.
SPS: 24V power supply error.	11	External 24V are not recognized.	Apply 24 V, replace PM hardware.
PM: Sensor cable error.	13	Sensor not connected, sensor cable defective.	Connect sensor.
SPS: Selected program number 0 is invalid.	14	Program no. 0 selected.	Select valid program.
PM: transmit buffer overflow.	95	Communication module does not react or is too slow.	Check RS232 connection / Hardware error.
PM: AC overdrive.	16	AC gain is too large.	Adjust gain. Reduce output voltage if gain is already to minimum.
PM: Data transfer too slow.	17	Manual entries during measuring.	Refrain from entering during measuring.
PM: Speed measurement not possible.	98	No reproducible tube circumference signals. Diameter or speed might be wrongly entered.	Correct diameter / speed, try another tube.
PM: Error bus module.	-	Fieldbus module not detected.	Check Fieldbus module.
PM: Bus transfer fault.	-	Fieldbus communication blocked for short period, due to high processor load.	Seldom possible due to system, problem will be redressed automatically. Check Fieldbus module, if frequently occurring.
PM: Short-circuit at sensor	18	Short-circuit	Check cable or sensor
PM: Flux leakage module defect	19	Fuse defect	Check fuse at flux leakage module
PM: Fan defect	21	Fan no signal	Check fan

Note also important instructions in following chapters:

2.5.6 – Reliability of Detection

2.7 – Measures for improvement of Weld Seam Detection

8.1 Troubleshooting at problems

- No detection of Weld Seam
- Too many „Critical Detections“
- Too many „ Wrong positioned“

are attributed to:

- Faults in machine construction (consult chapter 13.1 „Checklist“)
- Incorrect settings (consult chapter 13.1 „Checklist“)
- Deficiencies in maintenance (consult chapter 10 „Maintenance“ and chapter 13.1 „Checklist“)
- Product effects (consult chapter 2.7.1 „Factors that influence the Weld Seam Characteristic and the Detectability of Weld Seams“ and chapter 13.1 „Checklist“)

8.2 Creation of a sample tube

We recommend creating a sample tube for better delimitation of possible occurring problems:
Archive each type of tube an label it as follows:

Tube Type:	
Program number:	
Detection result (dB):	_____ dB
Date:	

If the detection quality becomes in the course of operation significantly bad, i.e. the number of outputs „*critical detection*“ is rising significantly, please insert the sample tube and check the result.

Detection result:	**Measure:**
The detection result has significantly changed	Make a check as indicated in the appendix check list for fault identification.
The detection result is the same	Use an adapted program; the characteristics of the weld seams have changed.
For further instructions follow previous chapter 7.1	

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9 Technical data

9.1 Control unit SND40

Technical Data	
Mains voltage:	85...264 VAC
Power consumption:	<110 W
Switch-on current:	<15 A/115V, <30 A / 230V
External fuse protection:	3.15 A medium-blow
Weight:	12 kg (26.5 lbs.)
Dimensions of industrial enclosure (L x W x H)* :	approx. 420 x 234 x 305 mm
	*approx. 435 x 234 x 305 mm (starting May 2016)
Protection class of industrial enclosure:	IP54
Ambient temperature:	0 - 40 °C (operation)

Further characteristics:

- Embedded PC with Windows CE operating system for user interface
- Real-time computer (ARM7) for detection and positioning
- Programming and operation via 10" Touchscreen
- 31 programs, selectable via parallel interface / field bus interface
- 8 potential free optocoupler inputs 24 V DC with common ground potential; sinking inputs.

  Specification:
  - min. switching voltage HIGH: 13 V DC
  - max. switching voltage HIGH: 30 V DC
  - min. switching voltage LOW: 0 V DC
  - max. switching voltage LOW: 4 V DC
- 8 potential free optocoupler outputs with common positive foreign supply 13… 30 V DC; sourcing outputs.

  Specification:
  - max. switched voltage: 30 V DC
  - max. switched current: 50 mA (internal current limitation)
  - max. contact rating: 1.5 W (only resistive load)

Note!
For inductive load a coil protection diode is to be used. Otherwise the signal output can be destroyed by the overvoltage when switching the inductive load off.

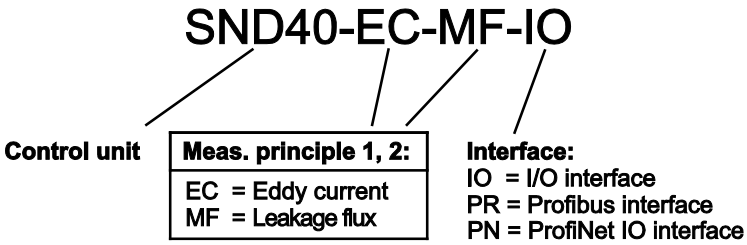
- 1 relay output (change-over contact)
- 1 relay output (closing contact), additionally only for SND40...MF… units
  Specification for Ohmic load:
  - max. switched voltage: 30 V DC / 250 V AC
  - max. switched current: 50 mA
  - max. contact rating: 180 W / 1500 VA
- USB 1.1 interface (front side)
  a) PCL3 compatible for printer, e.g. HP Deskjet HP5650, hp5652, hp6540 (other models must be registered in the operating system)

  b) for USB stick for software updating and backup of the program data, not until distribution with PC assembly NetDCU5.2 (approx. April 2006)

- 10 Mbit Ethernet interface (internal)
  - for general system access via TCP/IP (telnet)
  - IP address for Telnet 192.168.100.107, Subnet 255.255.255.000 (on delivery)
  - IP address for remote host 192.168.100.222 (on delivery)
- Fieldbus interface
  - Profibus DP interface, according to EN 50170, protocol v.1.10, max. Baud rate 12 Mbit/s
  - ProfiNet IO interface

9.1.1 Versions of control unit SND40

The equipment designation is coded as follows:



From this code key the following versions of the control unit result:

SND40-EC-IO	**SND40-EC-PR**	**SND40-EC-PN**
for Eddy current sensors, Eddy current probes, Encircling coil systems		
SND40-MF-IO	**SND40-MF-PR**	**SND40-MF-PN**
for Leakage flux sensors		
SND40-EC-MF-IO	**SND40-EC-MF-PR**	**SND40-EC-MF-PN**
for Eddy current sensors, Eddy current probes, Encircling coil systems, Leakage flux sensors, Combo sensors		

The SND40 control unit is delivered in different versions.

A version property is the measuring principle. Three versions are available:

- The combination unit **„EC-MF“** works with eddy current **and** leakage flux principle
- The eddy current unit „**EC“** works only with the eddy current principle
- The leakage flux unit **„MF“** works only with the magnetic leakage flux principle

The combined unit "EC-MF" represents with its combined sensors the future-proof solution for sophisticated Weld Seam Detection. The combination sensors are designed for both eddy current and magnetic flux leakage. The other two versions "EC" and "MF" are for special cases only. The matching sensors support only the respective principle.

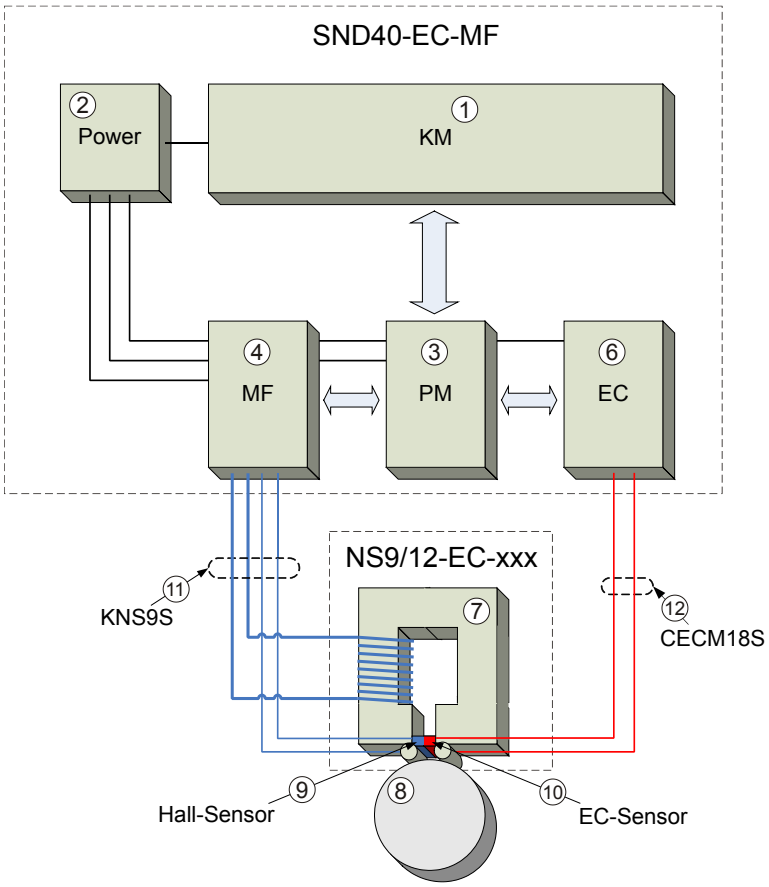
A specimen examination in the application laboratory of Roland Electronic GmbH clarifies which measuring principle is suitable for a process-safe detection. We strongly recommend not to make a selection of one certain measuring principle without a specimen report.

Another important version consists in the interface for control. There is the parallel I/O interface, via which the signal is exchanged. The usage of a fieldbus interface reduces the amount of wiring. Additionally, fault messages can be also read out. At present, Profibus DP and Profibus IO are available.

Note Using the fieldbus interface may require to pass the time-critical signal "weld seam detected" through the I/O interface to ensure accurate positioning. This is a way to avoid unpredictable latencies of the fieldbus communication, which may manifest in visible changes of accuracy positioning.

9.1.2 Block diagram SND40 with combination sensor

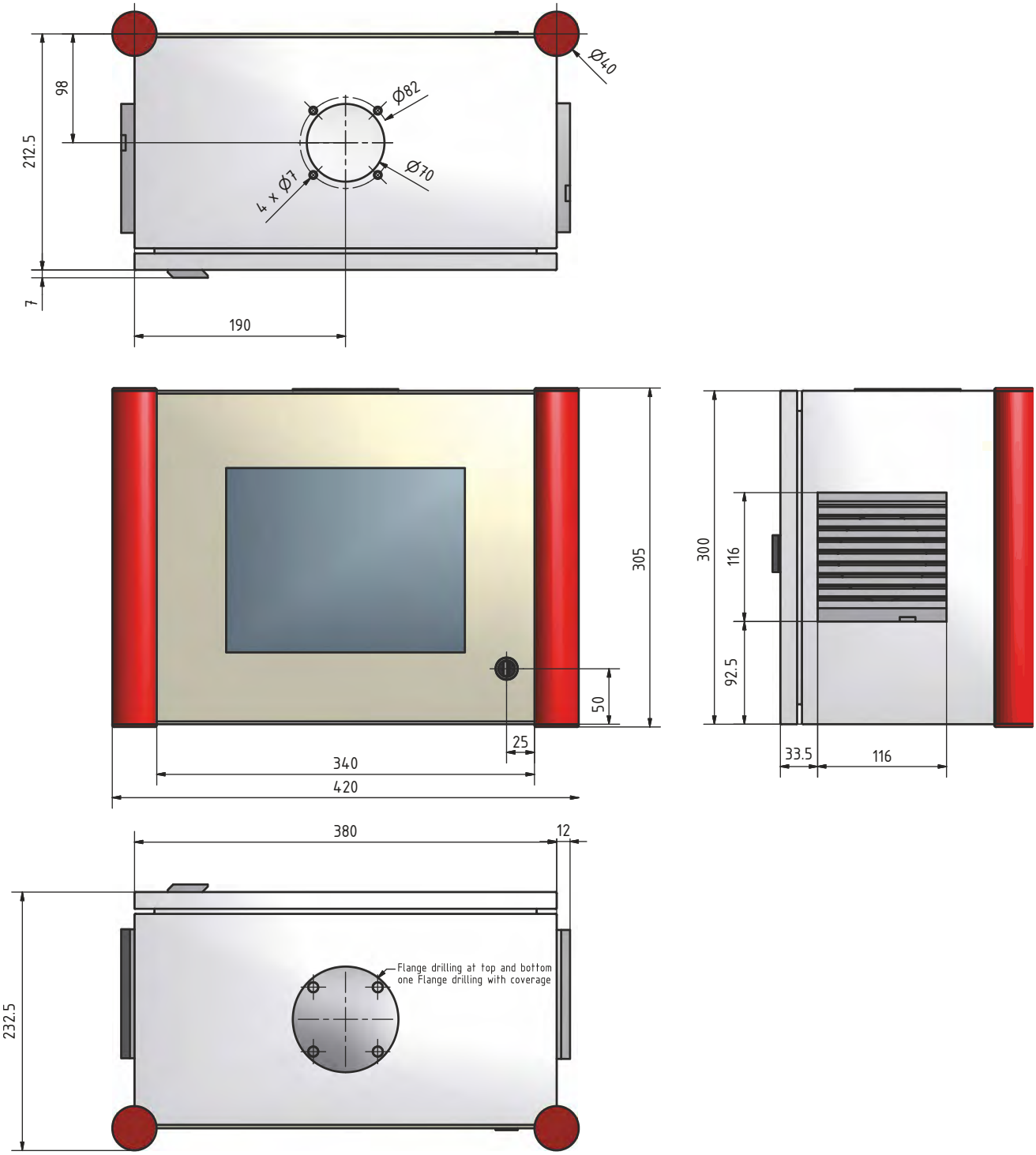
A system consists of a control unit SND40, a sensor and a sensor cable. The block diagram exemplarily shows a system with leakage flux module (4) and eddy current module (6). To it a combination sensor (7) for round materials is attached.



Description of block diagram:	
1:	**KM:** The communication module is the interface to the operator and stores the system and program files.
2:	**Power:** The power supply module supplies all internal modules and the sensors with electrical energy.
3:	**PM:** The processor module takes over the detection and positioning of the welding seam and controls the PLC interface.
4:	**MF:** The leakage flux module is the "front end" electronics to the Hall sensor and supplies the magnetizing current for the leakage flux and combination sensors. In addition a sensor (check signal) with current exit (0… +/-20mA) can be attached. This module is only present with SND40 devices with the numbers… MF… in the designation.
5:	*without representation:* Motherboard, on which the modules are attached.
6:	**EC:** The eddy current module is the "front end" electronics to the eddy current sensor. This module is only present with SND40 devices with the numbers… EC… in the designation.
7:	**NS9/12-EC…:** combination sensor consisting of magnetizing coil, (9) Hall sensor and (10) EC sensor.
8:	Round specimen, e.g. tube.
9:	Hall sensor for measuring the magnetic leakage flux. Unit is integrated in the sensor element of the combination and leakage flux sensors.
10:	EC sensor (eddy current probe) for generating and measuring the alternating field. Integrated in the sensor element of the combination and EC sensors.
11:	**KNS9S:** Sensor cable for combination and leakage flux sensors.
12:	**CECM18S:** Sensor cable for combination and EC sensors / probes.

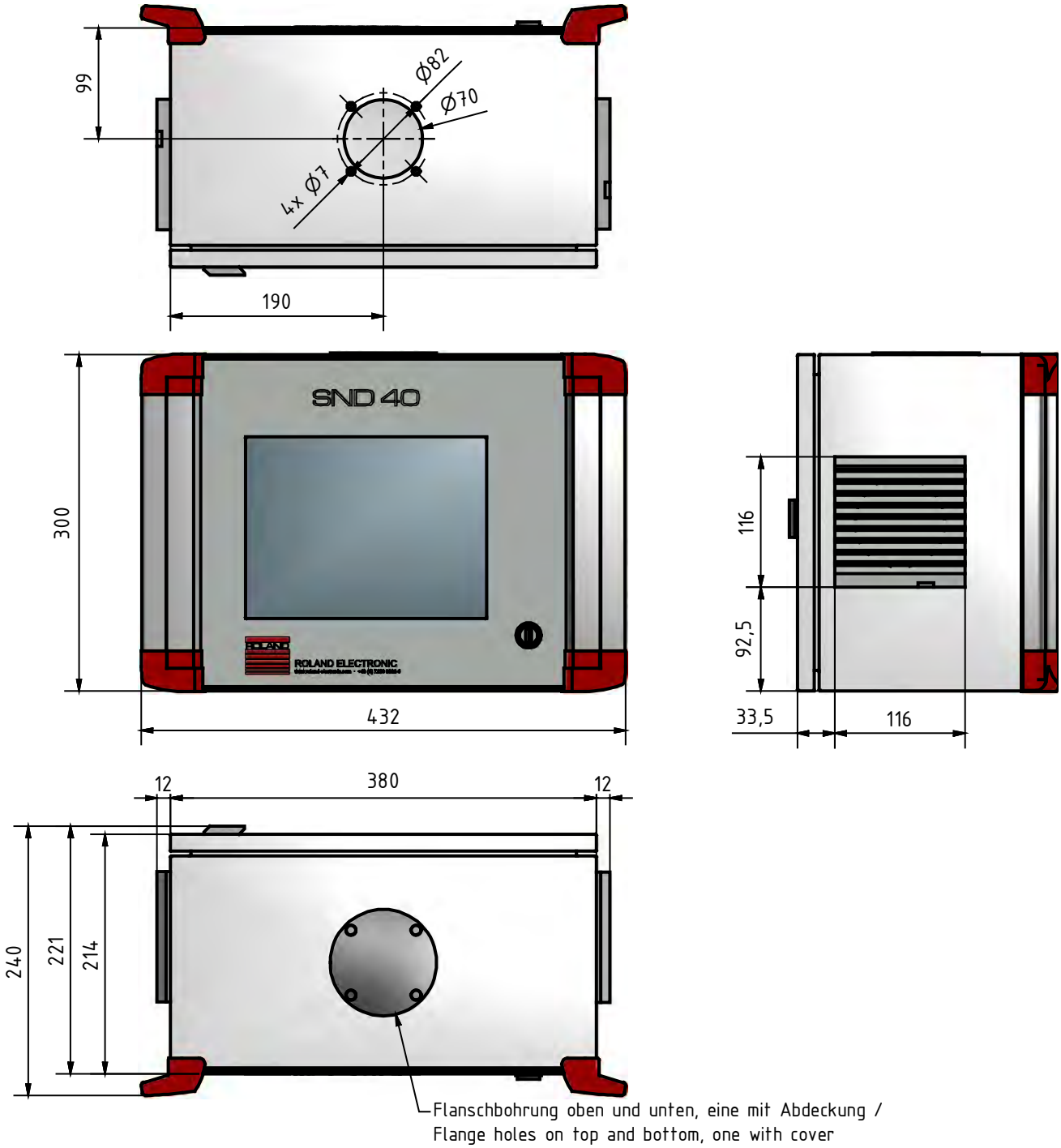
Fig. 34: SND40-EC-MF Block diagram

9.2 Mechanical drawing control unit SND40



All dimensions are in mm.

Fig. 35: SND40 Mechanical drawing of the unit (until 2016, May)



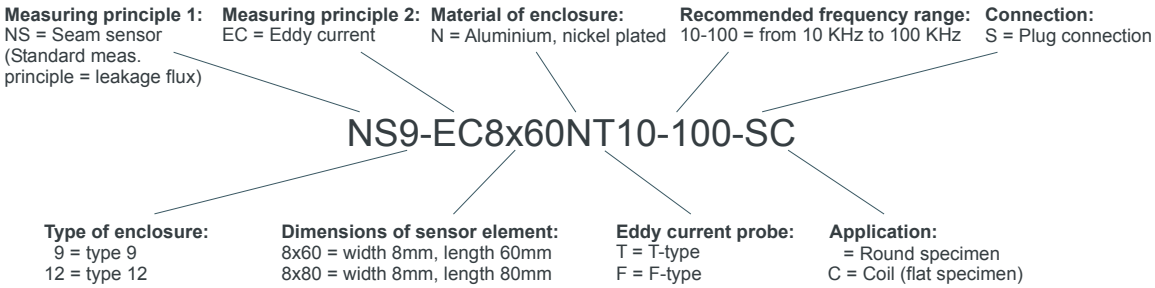
All dimensions are in mm.

Fig. 36: SND40 Mechanical drawing of the unit (from 2016, May)

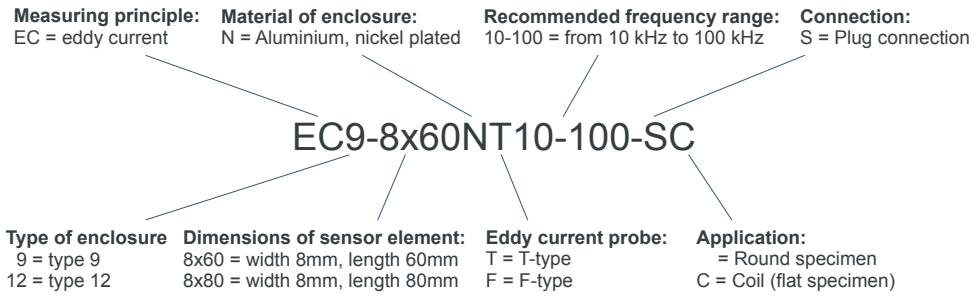
9.3 Designation of sensors

The sensor designations are coded as follows.

9.3.1 Combination sensors (leakage flux / eddy current)



9.3.2 Eddy current sensors



9.4 Leak flux sensor NS9SC KOMPLETT

Technical data		
Application:	Flat material (ferrous coils)	
Thickness of material:	Up to 3 mm	
Min. width of material:	100 mm	
Measuring principle:	Leakage flux	
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)	
Class of protection:	IP53	
Weight:	9.2 kg (20.3 lbs.)	
Material of enclosure:	Aluminum, nickel plated	
Sensor cable:	KNS9S	
Accessories:	Support roller block NS9SC	
Air gap between pole boots and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	The air gaps must be above the smallest permissible value. If the smallest permissible value is – due to wearing - under-run, the sensor needs to be repaired (see also chapter 10 “Maintenance”).
Air gap between sensor element and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	

* Accessories included

9.5 Combination sensor NS9-EC8x35NF10-100-SC KOMPLETT*

Technical data		
Application:	Flat material (ferrous / non-ferrous coils)	
Thickness of material	Depending on material	
Min. width of material:	100 mm	
Measuring principle:	Magnetical leakage flux, eddy current (high resolution, only for non-ferrous material)	
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)	
Class of protection:	IP53	
Weight:	7.5 kg (16.5 lbs.)	
Material of enclosure:	Aluminum, nickel plated	
Sensor cable:	KNS9S (leak flux) CECM18S-G (eddy current)	
Accessories:	Support roller block NS9SC	
Air gap between pole boots and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	The air gaps must be above the smallest permissible value. If the smallest permissible value is – due to wearing - under-run, the sensor needs to be repaired (see also chapter 10 “Maintenance”).
Air gap between sensor element and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	

* Accessories included

9.6 Combination sensor NS9-EC8x35NT10-100-SC KOMPLETT*

Technical data		
Application:	Flat material (ferrous / non-ferrous coils)	
Thickness of material:	Depending on material	
Min. width of material:	100 mm	
Measuring principle:	Magnetical leakage flux, eddy current	
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)	
Class of protection:	IP53	
Weight:	7.5 kg (16.5 lbs.)	
Material of enclosure:	Aluminum, nickel plated	
Sensor cable:	KNS9S (leak flux) CECM18S-G (eddy current)	
Accessories:	Support roller block NS9SC	
Air gap between pole boots and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	The air gaps must be above the smallest permissible value. If the smallest permissible value is – due to wearing - under-run, the sensor needs to be repaired (see also chapter 10 “Maintenance”).
Air gap between sensor element and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	

* Accessories included

9.7 Eddy current sensor NS9NH-EC6x24NT10-100SC KOMPLETT*

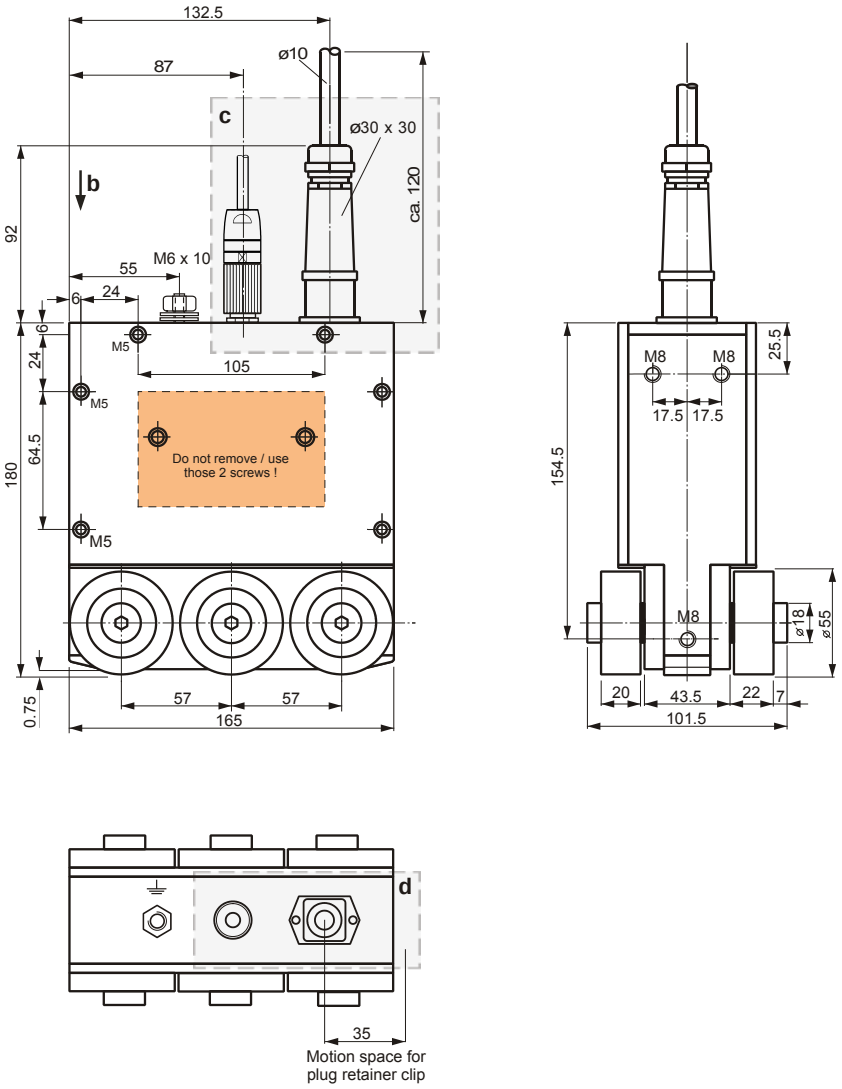
Technical data		
Application:	Flat material (non-ferrous coils)	
Thickness of material:	Depending on material	
Min. width of material:	100 mm	
Measuring principle:	Eddy current (high resolution)	
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)	
Class of protection:	IP53	
Weight:	6.5 kg (14.5 lbs.)	
Material of enclosure:	Aluminum, nickel plated	
Sensor cable:	CECM18S-G	
Accessories:	Support roller block NS9SC	
Air gap between pole boots and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	The air gaps must be above the smallest permissible value. If the smallest permissible value is – due to wearing - under-run, the sensor needs to be repaired (see also chapter 10 “Maintenance”).
Air gap between sensor element and sheet	1.0 … 1.1 mm in new condition 0.5 mm is smallest permissible value	

* Accessories included

9.7.1 Technical drawing NS9SC / NS9SC-…-SC / EC9-…-SC

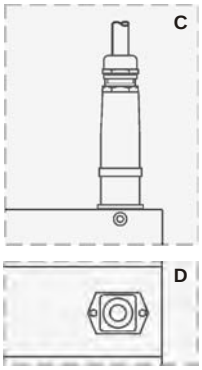
Note!

When using the supplied rubber mounts, the total width extends (for 50 mm, 25 mm per mount) from 165 mm to 215 mm.

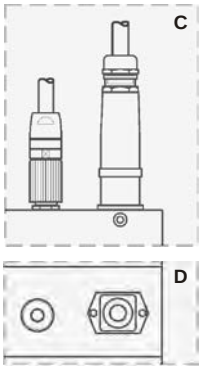


Detail section
Specification
of connection

Leak flux sensor
NS9SC



Combo sensor
NS9-EC8-xxx-SC



Eddy current sensor
EC9-xxx-SC

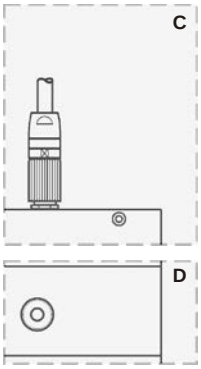


Fig. 37: NS9SC

9.8 Support roller block (Stützschuh)

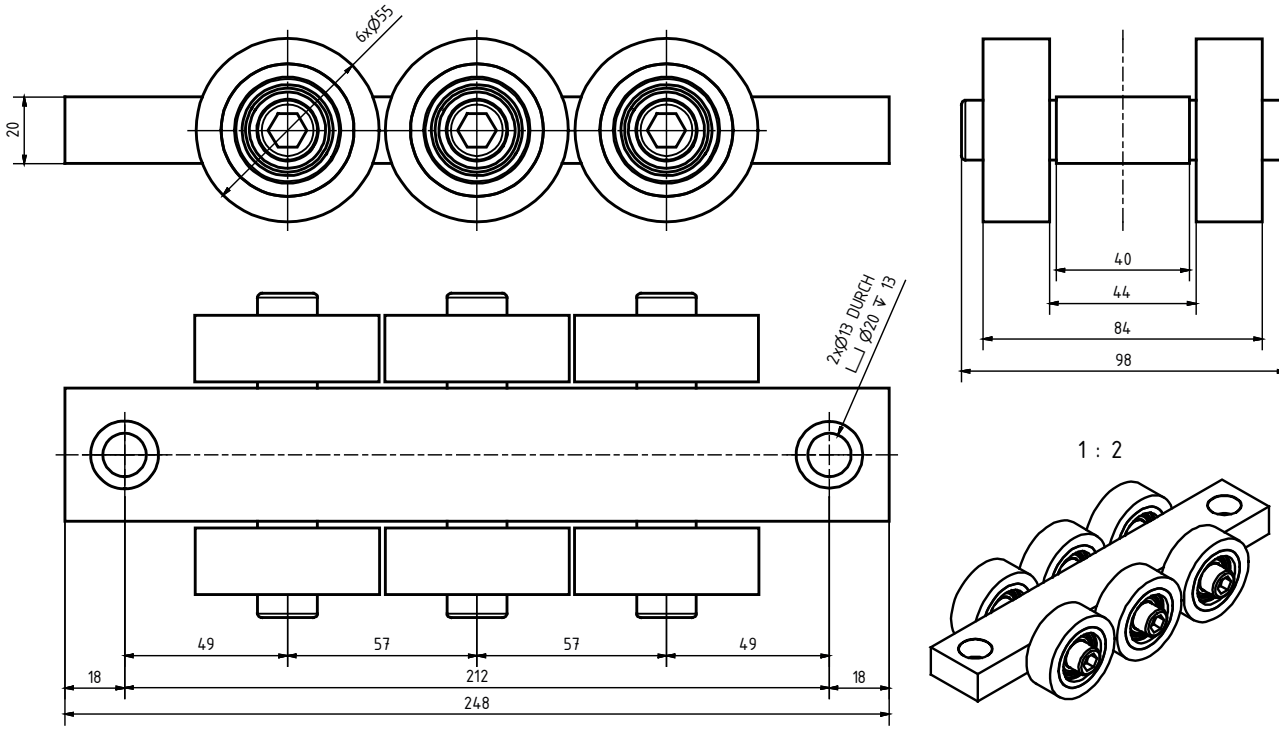
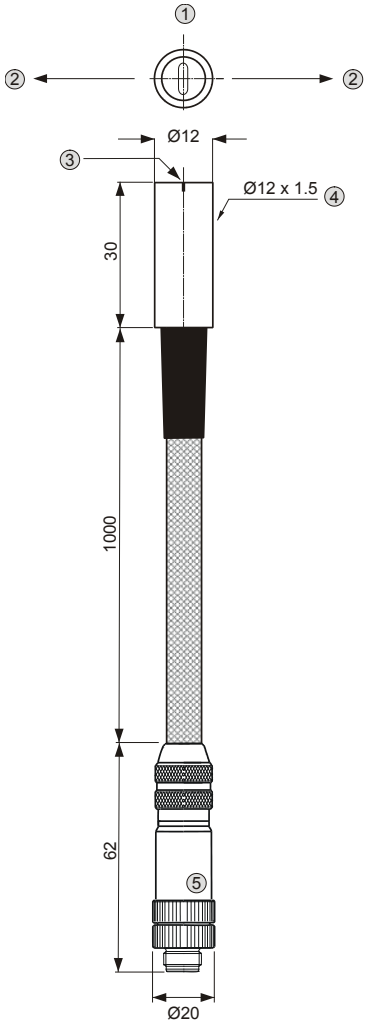


Fig. 38: Support roller block

9.9 Eddy current probe EC12x30IT10-100-S

Technical data	
Application:	Round material Flat material
Diameter of tube:	unlimited
Wall thickness:	Depending on material
Measuring principle:	Eddy current
Arrangement:	axial
Width of track:	4 mm
Width of measuring patch:	6 mm
Ambient temperature:	10 - 40°C (50 – 104°F) (operation)
Class of protection:	IP65
Weight:	0.15 kg (0.33 lbs)
Material of enclosure:	Stainless steel
Sensor cable:	CECM18S-G
Sensor Connection Box:	SCB-EC-S

9.9.1 Technical drawing EC12x30IT10-100-S



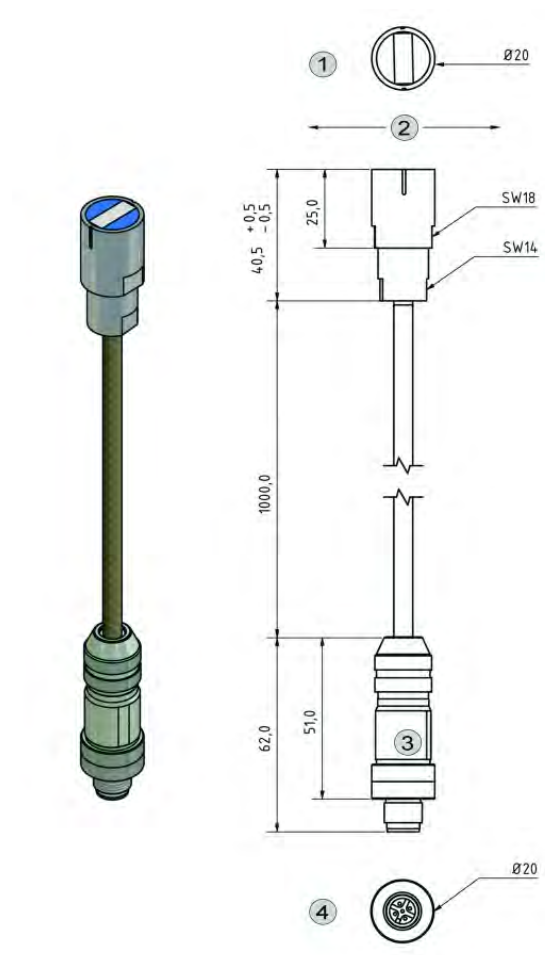
Description	
1:	View – active area
2:	Direction of material flow
3:	Marking
4:	sleeve Ø12 x 1.5 made of INOX
5:	Cable plug Order no.: 2277704
	All dimensions are in mm.

Fig. 39: EC12x30IT10-100-S

9.10 Eddy current probe EC20x25IT10-100-S

Technical data	
Applications:	Round material Flat material
Diameter of tube:	unlimited
Wall thickness:	Depending on material
Measuring principle:	Eddy current
Arrangement:	axial
Width of track:	10 mm
Width of measuring patch:	13 mm
Ambient temperature:	10 - 40° C (50 – 104°F) (operation)
Class of protection:	IP65
Weight:	0.2 kg (0.44 lbs)
Material of enclosure:	Stainless steel
Sensor cable:	CECM18S-G
Sensor Connection Box:	SCB-EC-S

9.10.1 Technical drawing EC20x25IT10-100-S



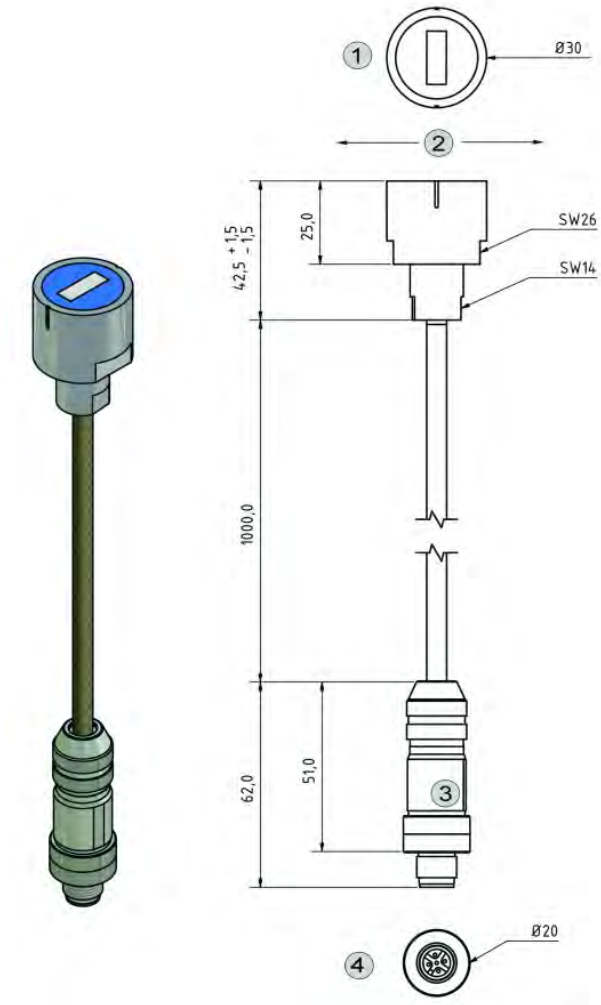
Description	
1:	View – active area
2:	Direction of material flow
3:	Cable plug order no.: 2277704
4:	View – cable plug
	All dimensions in mm

Fig. 40: EC20x25IT10-100-S

9.11 Eddy current probe EC30x25IT10-100-S

Technical data	
Application:	Round material Flat material
Diameter of tube:	unlimited
Wall thickness:	Depending on material
Measuring principle:	Eddy current
Arrangement:	axial
Width of track:	16 mm
Width of measuring patch:	20 mm
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)
Class of protection:	IP65
Weight:	0.3 kg (0.66 lbs)
Material of enclosure:	Stainless steel
Sensor cable:	CECM18S-G
Sensor Connection Box:	SCB-EC-S

9.11.1 Technical drawing EC30x25IT10-100-S



Description	
1:	View – active area
2:	Direction of material flow
3:	Cable plug order no.: 2277704
4:	Cable plug
	All dimensions are in mm.

Fig. 41: EC30x25IT10-100-S

9.12 Eddy current probe EC5x30IF10-100-S

Technical data	
Application:	Round material flat material
Diameter of tube:	unlimited
Wall thickness:	Depending on material
Measuring principle:	Eddy current (high resolution)
Arrangement:	axial
Width of track:	1.5 mm
Width of measuring patch:	2 mm
Ambient temperature:	10 - 40 °C (50 – 104°F) (operation)
Class of protection:	IP65
Weight:	0.15 kg (0.33 lbs)
Material of enclosure:	Stainless steel
Sensor cable:	CECM18S-G
Sensor Connection Box:	SCB-EC-S

9.12.1 Technical drawing EC5x30IF10-100-S

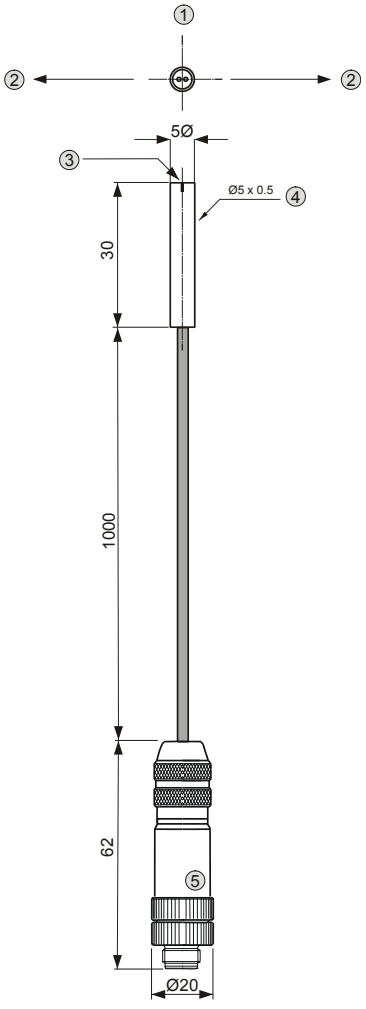


Fig. 42: EC5x30IF10-100-S

Description	
1:	View – active area
2:	Direction of material flow
3:	Marking
4:	Sleeve Ø 5 x 0.5, made of Stainless steel
5:	Cable plug order no.: 2277704
	All dimensions are in mm.

9.13 Encircling coil system EC5x25IDN50-500-S KOMPL.

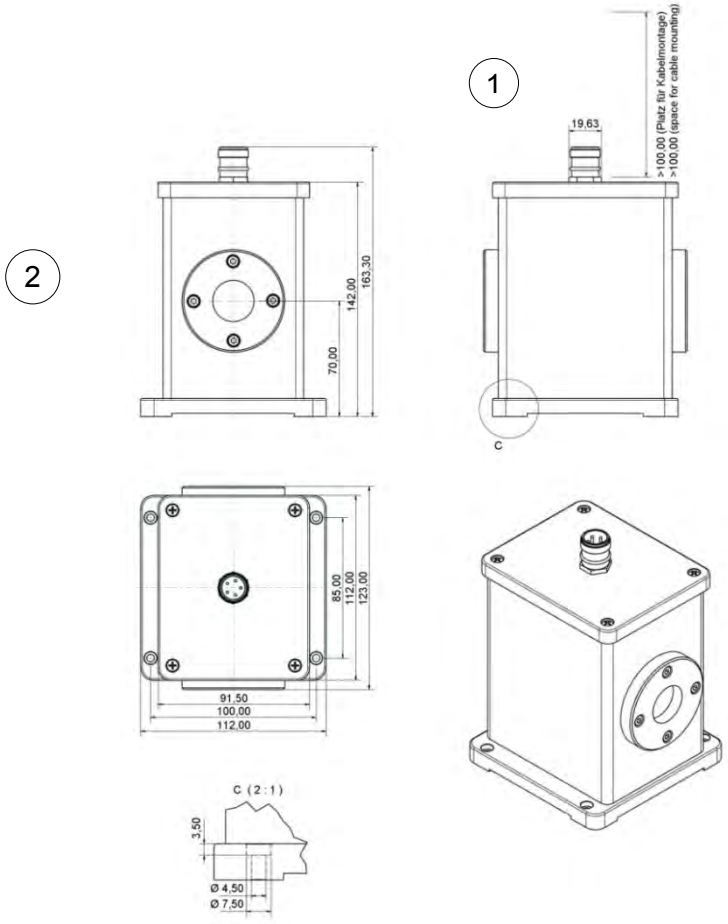
Technical data	EC5x25IDN50-500-S KOMPL.	EC13x25PDN50-500-S KOMPL.	EC20x25IDN50-500-S KOMPL.
Application:	Cables, wires (crosswise weld seams)		
Diameter of material:	max. 4.5 mm	max. 12 mm	max. 16 mm
Wall thickness:	depending on material		
Measuring principle:	Eddy current		
Width of measuring patch:	8 mm	15 mm	15 mm
Arrangement:	Encircling coil		
Ambient temperature:	10 - 40° C (50 – 104°F) (operation)		
Class of protection:	IP54		
Weight:	1.0 kg (2.20 lbs.)		
Material of enclosure:	Aluminum		
Sensor cable:	CECM18S-G		

9.14 Encircling coil system EC13x25PDN50-500-S KOMPL.

Technical Data see table

9.15 Encircling coil system EC20x25IDN50-500-S KOMPL.

Technical Data see table



Description	
1:	> 100mm Measure with free space for connecting sensor and cable
2:	Diameter EC5x25: 5 mm EC13x25: 13 mm EC20x25: 20 mm

The term „PDN“ specifies sensors with guide sleeves made of plastic material.

The term „IDN“ specifies sensors with guide sleeves made of Stainless Steel.

Fig. 43: EC13x25PDN50-

9.15.1 Connection schedule SND40 (general)

The following illustration shows the connection schedule of a SND40 with one sensor as well as with two sensors via a sensor switch box, together with the names of the required cables.

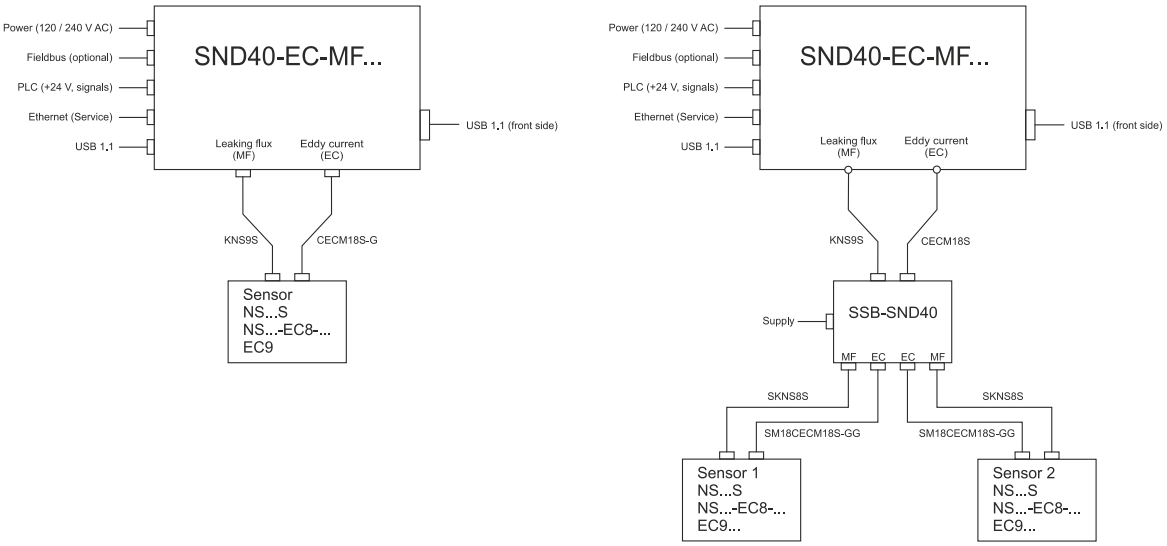


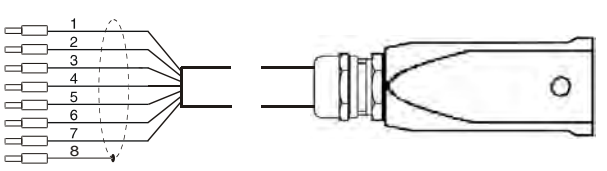
Fig. 44: Connection schedule with 1 sensor and with 2 sensors via sensor switch box

9.16 Sensor cable KNS9S

Usage: Connecting the combo sensors and the leakage flux sensors to the control unit.

The cable has a cable socket at the sensor side, and open end wires with wire-end ferrules at the control unit side.

Versions of cable:	**KNS9S-G:** **straight cable socket at sensor side**	**KNS9S-W:** **angled cable socket at sensor side**



Cable socket at sensor side: Harting HAN8

1:	white	+12 V
2:	green	-12 V
3:	Brown **(+blue)***	AGND
4:	yellow	Meas. signal 1
5:	red	Meas. signal 2
6:	grey	+coil
7:	pink	-coil
**8:	blank	shield

Fig. 45: KNS9S-G

Cable diameter: 8.7 mm
Structure: 8 × 0.5 mm^2, LiYCY
Bending radius: 54 mm: laid fixed, 130 mm: laid flexible

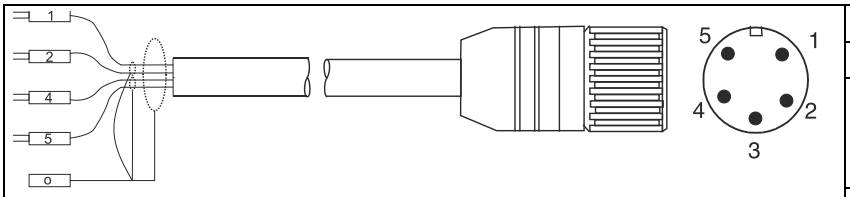
Note For cables delivered starting Nov. 2014 following applies:
A ***brown wire might be connected parallel together with a ***blue*** wire.
****Contact Nr. 8 might be connected with the cable shield. This will **not affect** the proper functionality of the cable, the sensor or the control unit.

9.17 Sensor cable CECM18S-G

Usage: Connecting the combo sensors and the eddy current sensors to the control unit.

On using eddy current probes, the sensor connection box SCB-EC-S must be used additionally.

The cable has a cable socket at the sensor side, and open end wires with wire-end ferrules at the control unit side. Standard length is 5 meters, other lengths must be specified.



Cable socket at sensor side: Coninvers M18, Roland 2276010

1:	green	Transmitter / a
2:	yellow	Transmitter / b
3:	Inner stranded cable shields	Ground
4:	white	Meas. signal 1
5:	brown	Meas. signal 2
	External cable shield to socket enclosure	

Fig. 46: CECM18S-G

Cable diameter: 9.5 mm
Structure: 2 × 2 × 0.25 mm^2, CY – PIDY(TP)
Bending radius: 57 mm, laid fixed
150 mm, laid flexible

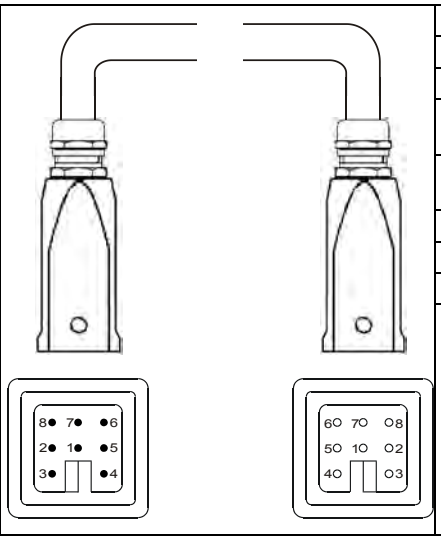
9.18 Sensor cable SKNS8S

Usage: Connecting the combo sensors and the leakage flux sensors to the sensor switch box.

The cable has a cable socket at the sensor side, and a cable plug at the control unit side.
Standard cable length is 5 meters, other lengths must be specified.

1:	white	+12 V
2:	green	-12 V
3:	brown**(+blue)***	AGND
4:	yellow	Meas. signal 1
5:	red	Meas. signal 2
6:	grey	+coil
7:	pink	-coil
8:	---	

Control unit side
cable plug
(Harting HAN8)



1:	white	+12 V
2:	green	-12 V
3:	brown **(+blue)***	AGND
4:	yellow	Meas. signal 1
5:	red	Meas. signal 2
6:	grey	+coil
7:	pink	-coil
8:	---	

Sensor side
cable socket
(Harting HAN8)

Fig. 47: SKNS8S

Cable diameter: 8.7 mm
Structure: 8 × 0.5 mm^2, LiYCY
Bending radius: 54 mm: laid fixed, 130 mm: laid flexible

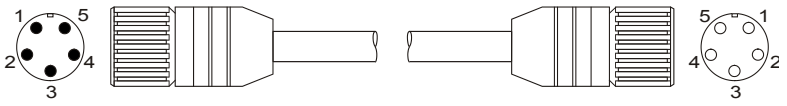
Please observe the notes (*, **) for sensor cable KNS9S. These are identic to the sensor cable SKNS8S!

9.19 Sensor cable SM18CECM18S-GG

Usage: Connecting the Eddy current sensors as well as the combosensors and the encircling coils to the sensor switch box.

For using Eddy current probes the Sensor Connection Box SCB-EC-S must be used in addition.

The cable has a cable socket at the sensor side and a cable plug at the switch box side.
Standard cable length is 5 meters, other lengths upon request.



Cable plug at Switch box side
Roland 2277010, M18,
supplier: Coninvers

Cable socket at Sensor side
Roland 2276010, M18,
supplier: Coninvers

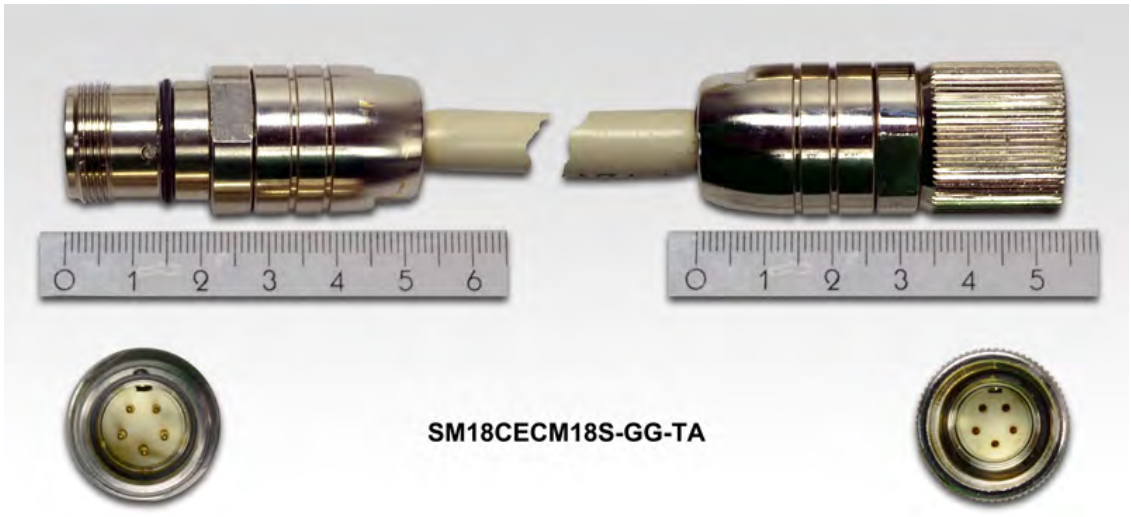
1:	green	Sender / a
2:	yellow	Sender / b
3:	Inner cable shieldings	Ground
4:	white	Meas. signal 1
5:	brown	Meas. signal 2
External cable shielding connected to enclosure		

Fig. 48: Cable SM18CECM18S-GG

Cable diameter: 9.5 mm
Structure: 2 × 2 × 0.25 mm^2, CY – PIDY(TP)
Bending radius: 57 mm, laid fixed / 150 mm, laid flexible

9.20 Extension cable SM18CECM18S-GG-TA

Usage: Extension of eddy current cables SM18CECM18S-GG respectively CECM18S-G



Cable plug at extension side
Roland 2277016, M18,
supplier: Coninvers

Cable socket at Sensor side
Roland 2276010, M18,
supplier: Coninvers

Fig. 49: Extension cable SM18CECM18S-GG-TA

Cable diameter: 9.5 mm
Structure: 2 × 2 × 0.25 mm^2, CY – PIDY(TP)
Bending radius: 57 mm, laid fixed
150 mm, laid flexible

9.21 Sensor Switch Box SSB-SND40

With help of the switch box two eddy current sensors, leakage flux sensors or combination sensors can be connected with the SND40 control unit. Measuring via the switch box is always done by selection resp. sequentially.

Switching over to another sensor is exclusively controlled by the PLC. The SND40 does not receive any information about the selected sensor, thus the switch-over may only happen during the measuring pause. Depending on type of sensor and task, the PLC must perform an additional program switching on the SND40. This must be considered on planning the arrangement.

A 24V input serves for controlling the switch-over function.

The sensor cables are connected at corresponding flange sockets.

The allocated cables SKNS8S and SM18CECM18S-GG need to be ordered separately.

The PLC control cable is connected to a M12 flange socket.

The control cable is a part of the allocated machine and does not belong to the scope of supply.

9.21.1 Technical drawing

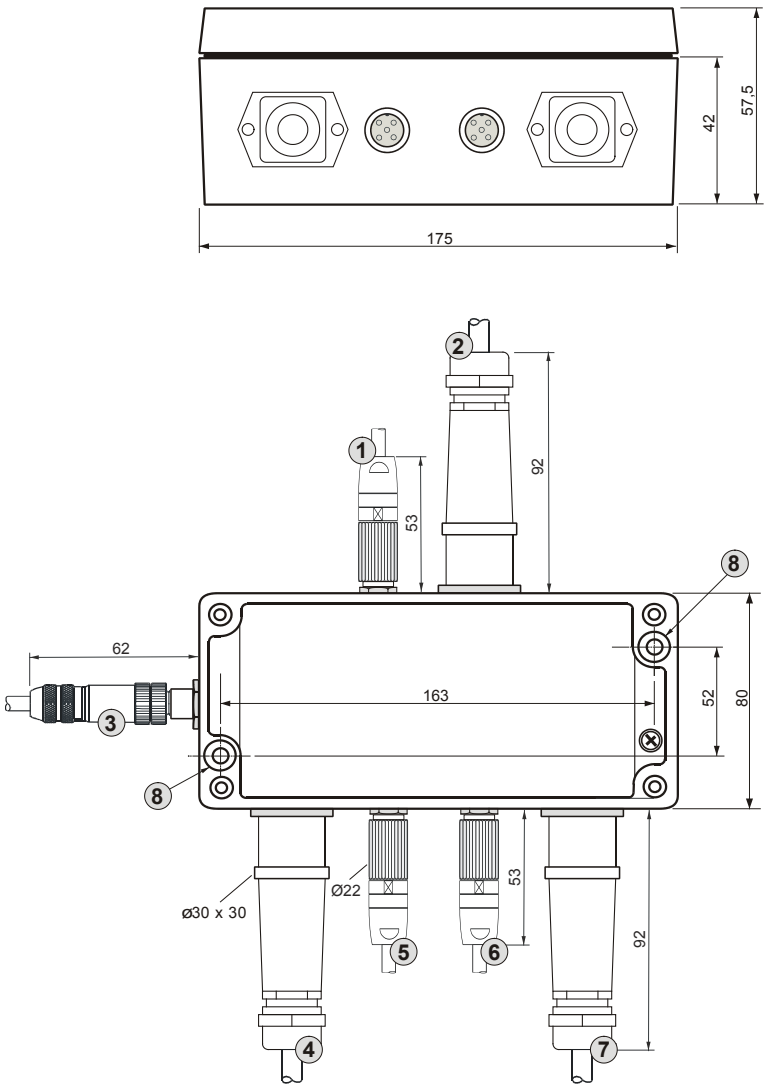
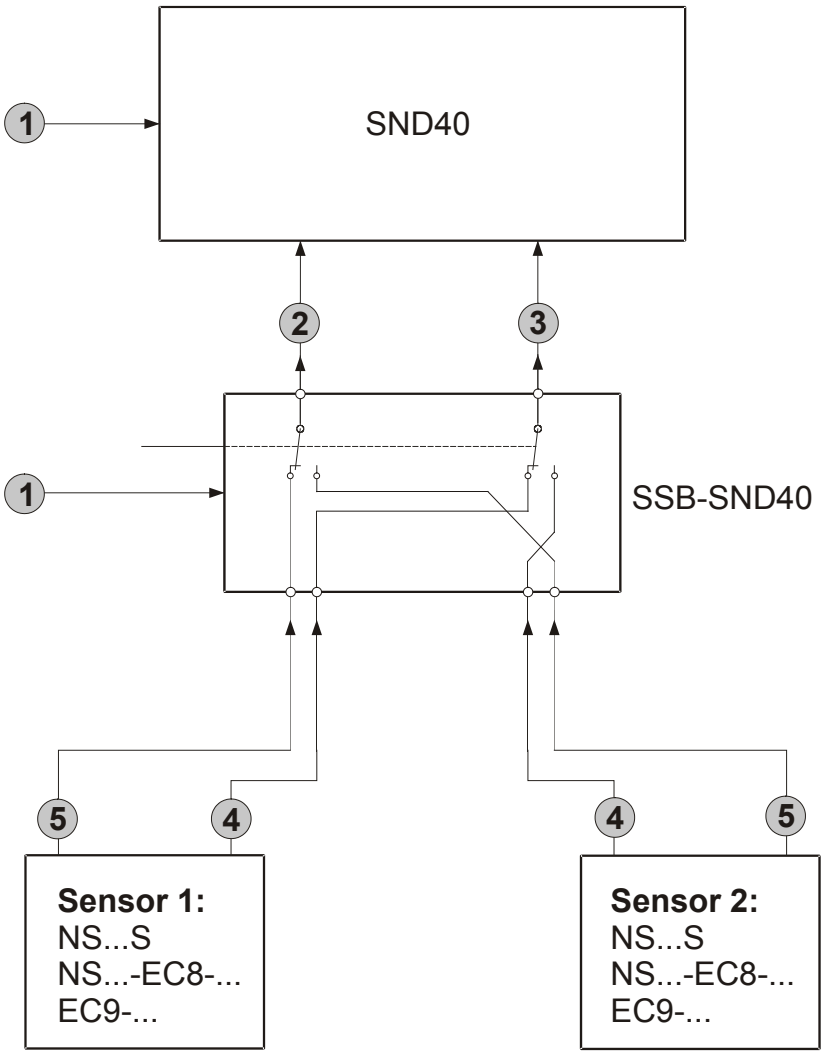


Fig. 50: SSB-SND40 technical drawing

Description	
1:	**SND40** Eddy current connection
2:	**SND40** Leakage flux connection
3:	**SPS** Control connection
4:	**Sensor 1** Leakage flux connection
5:	**Sensor 1** Eddy current connection
6:	**Sensor 2** Eddy current connection
7:	**Sensor 2** Leakage flux connection
8:	Drilling for mounting Ø 5

9.21.2 Connecting scheme



Description	
1:	**SPS** -> SND40 / SSB-SND40 Supply connection
2:	**KNS9S** Cable (leakage flux)
3:	**CECM18S-G** Cable (eddy current)
4:	**SM18CECM18S-GG** Sensor cable (eddy current)
5:	**SKNS8S** Sensor cable (leakage flux)

Fig. 51: SSB-SND40 connecting scheme

9.21.3 PLC supply / control connection scheme

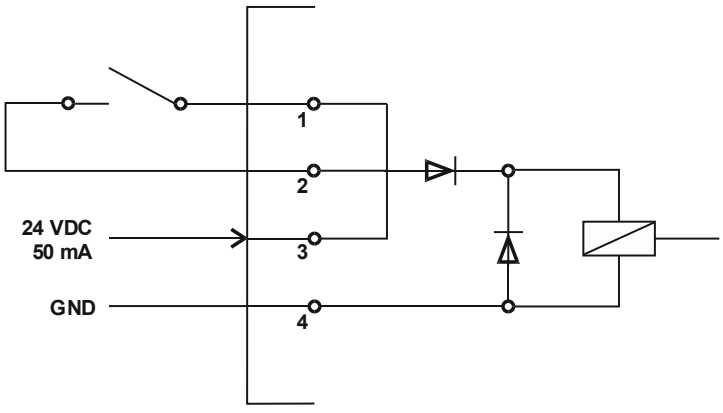


Fig. 52: PLC supply / control connection scheme

9.22 Sensor Connection Box SCB-EC-S

Using eddy current probes requires use of the Sensor Connection Box SCB-EC-S. This box contains the protective resistor for limiting the transmitter current. For the larger combination sensors, eddy current sensors and encircling coil sensors the box is not needed.

The sensor is connected to the box with the cable belonging to the sensor. For connecting the box to the control unit / sensor-switch-box the cable CECM18S-G is required.

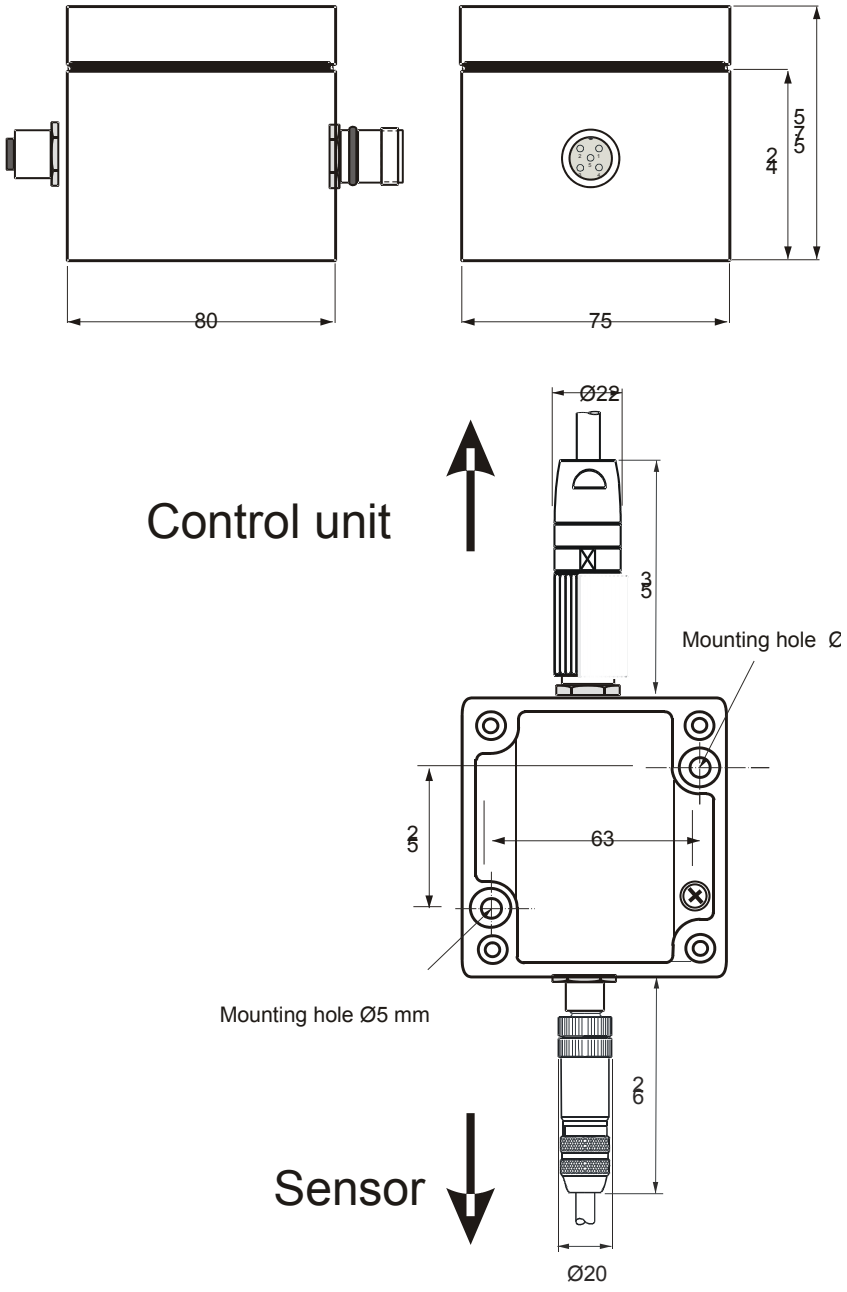
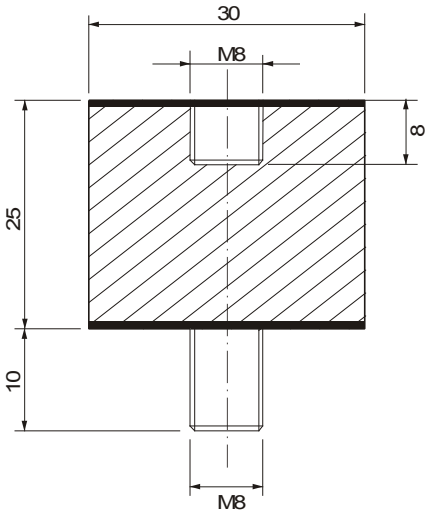


Fig. 53: SCB-EC-S

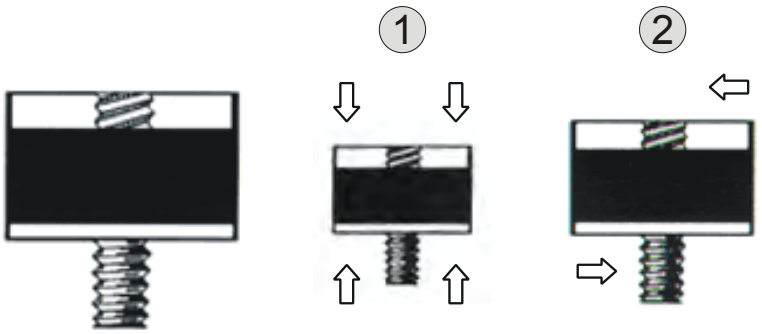
9.23 Rubber mounts for NS9 and NS12



Properties	
Material:	NBR (Acrylnitril-Butadien)
	Metal parts zinc plated and chromated
Hardness:	45+ / -5 Shore A
All dimensions in mm.	

Fig. 54: Rubber mounts

Further properties		
Spring rate (compression):	180 N/mm	1000 lbs/in.
Max. compression travel:	1.5 mm	0.06 in.
Max. compression force:	270 N	60 lbs
Spring rate (shearing):	28 N/mm	160 lbs/in.
Max. shear travel:	3.8 mm	0.15 in.
Max. shear force:	110 N	25 lbs



Description	
1:	Compression
2:	Shearing

Fig. 55: Rubber mounts

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10 Maintenance

10.1 Control unit SND40

In order to simplify a possible replacement of the unit, periodical data backup via network (see "*data backup via network*" in chapter "*technical information*") or on USB stick (see "*SND40 Store*") is required. If new programs are created rarely, data backup can be performed at this moment.

10.2 Sensors NS9…SC, EC9…SC

During operation, the rollers can face wearing and damage. Thus, inspection in regular intervals contributes to long-term maintain the functionality of the sensor. Normally a quarterly inspection interval is sufficient.

1. Inspecting the dimensions of the rollers: In new condition the rollers have a diameter of 55 mm ± 0.1 mm. Change the rollers when the diameter falls short of 53.5 mm.

Important Always check all 6 rollers for even wearing. If the 6 rollers are not evenly worn-out, this is an indication for uneven distribution of loading force, due to mis-mounting of the sensor. Here the alignment in all 3 axis is to be checked and corrected (see also: mounting errors) if required.

Note Measure the diameter of a roller at various points.
The deviation at the same roller may not exceed ± 0.1 mm

2. Inspecting the bearings and mountings: Due to permanent operation, it might (rarely) happen that one of the roller mountings will become loose. In this case, the affected mounting and the assigned bearings must be inspected.

3. Replacement of the rollers: After having replaced the rollers, their diameters may not differ from each other for more than ± 0.2 mm. Thus all 3 rollers of one side need to be replaced in most cases.

4. Visually inspecting the active sensor face: Normally the active sensor face does not touch the material, since it always has a certain distance (air gap) to the material. It must be free of major wearing marks and grooves. If e.g. the screw heads of the pole shoes are worn-off, this can be repaired only with large expenditure. In the worst case such a sensor becomes unrepairable. Frequent reasons for such chaff marks are rollers with diameters below the limits, where the sheet gets into contact with the sensor face.
The value ranges for the air gaps can be read from the technical data of the respective sensor.

5. Inspecting the rubber cushions: Among other things, the rubber cushions compensate slight tolerances in mounting. Furthermore, they enable the sensor to better contact the material surface. However, a rubber cushion can break, when the sensor was excessively deflected during a collision with the material. Sometimes a broken rubber cushion can be recognized by a mis-position of the sensor. In any case, a damaged rubber cushion must be replaced.

6. Cleaning the sensor face (active underside): Due to the use of a permanent magnet, metal particles can cumulate at the sensor face. Whenever such residues are recognized, the sensor should be cleaned with compressed air.

7. Inspecting the electrical components: Inspect cables, connectors and grounding line for damage, correct layout and tight fit (plugs and screw terminals). Loosened cables are endangered to being jammed or chaffed. Always replace damaged or chaffed cables.

10.2.1 Air gaps and wearing limits of the sensors

Due to the wearing of the rollers, the air gaps at the sensor decrease. When the wearing limit has been reached, the rollers need to be exchanged by new ones.

The following chart shows the air gaps of the sensors in new condition as well as the minimal permissible air gaps at the wearing limit.

NS9…-SC (Coil)	
Air gap between pole boots and sheet in mm (inch)	
in new condition	1,0 - 1,1 (.039" - .043")
at wearing limit	< 0,5 (.02")
Air gap between sensor element and sheet in mm (inch)	
in new condition	1,0 - 1,1 (.039" - .043")
at wearing limit	< 0,5 (.02")

10.3 Regular wearing and increased wearing

During operation, a sensor is subject of a certain regular wear. Thus, the sensors need to be inspected in regular intervals and worn components must be replaced.

If increased wear within a short period is detected, this is a symptom for one or more of the fault conditions shown below. The cause for this should be immediately found and redressed. In the worst case a sensor can be unrepairable damaged.

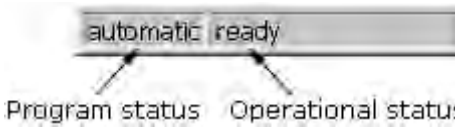
A further symptom for increased wear within a short period is the gradual drift of the measuring values, because they depend on the mechanical conditions.

The case when increased wear is existing depends considerably on the individual conditions of application.

Increased wear	Comment	Reduced wear
Sensor is mounted wrongly or unfavourably. Sensor is not correctly aligned.	The sensor can no longer move suspended in the bracket or runs unevenly on the material. The rubber mounts might break. The rollers do not touch down simultaneously and evenly onto the surface, the sensor runs tilted on the material (the rollers are „rubbing" over the surface and wear-out unevenly or prematurely).	Take care that the sensor is correctly mounted in the bracket. Align the sensor correctly. **All sensor rollers must be in contact with the surface and rotate!** This applies also for tubes as well as for coils.
Rubber mount is damaged or broken.	Damaged / broken rubber mounts can no longer provide for elastic suspending and correct guidance. Thus a mis-positioning and a wrong alignment of the sensor results.	Replace damaged rubber mounts.
Jacking force too large.	If the sensor is pressed onto the material with too much force, the rollers and the bearings wear-out too fast. The rubber mounts might break. The sensor should be pressed onto the material with a force which equals its own weight.	Reduce the jacking force. If the attached rubber mounts are used, the sensor should comply only for up to 5mm when touching-down.
Touch down motion too vehement.	Vehement touch down motions causes severe impacts on the rollers, their bearings and shafts. The rubber mounts as well as the bearings of the rollers might break.	Cushion the touch down motion.
Very uneven material surface.	The nature of the material surface can considerably influence the wearing of the sensor.	

10.4 Program status / Operational status

Program status	Operational status
Inactive	**System start**
	Program invalid
	Inactive
	System configuration invalid
Automatic	**Ready**
	Active
	Program change
	Program invalid
	Error
	Done
	Inactive
	System configuration invalid
	Section active
Setup	**Edit**
	Active
	Program change
	Error
	Program invalid
	Measurement stopped
	Inactive
	System configuration invalid
	Speed meas. finished
	X/Y active
	X/Y sampling done
	Section active
	Wait for PLC



10.4.1 Operational conditions in program status „Automatic“

Ready: Neither a program change nor a detecting job is active. The unit is ready for the next job or program change via PLC. The operator can use the keys “Print”, “Statistics”, “Program” or “System”.

Active: A detecting job was started by the PLC. This operational condition will be automatically terminated, as soon as the positioning procedure has been performed. When no error condition is existing, the condition changes over to “Ready”.

Program change: A program change was started by the PLC. This operational condition will be automatically terminated, as soon as the change has been performed by the PLC, also if a change was not possible since a non-existing program number was selected. Then a message is released which will be displayed in the “error message” field.

Note: In this case the unchanged program number will be mirrored back at the PLC interface, since the change was not possible.

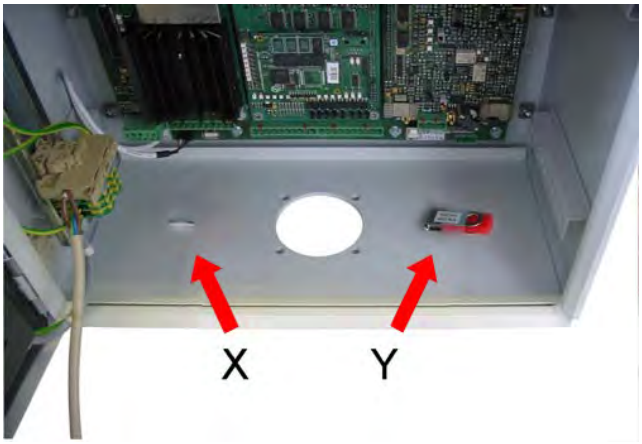
Error: A started detecting job cannot be executed. An operator intervention is required to redress this condition. The cause for this condition may be internal or external disturbances which do not redress themselves. In the field “error message” the triggering error message is shown.

10.5 SND40_10Store

SND40_10Store is an easy-to-handle aid for saving / restoring program and system files, as well as to update the application software for the Weld Seam Detector SND40.

Requirements:

- Hardware version of the SND40, based on processor module NetDCU10
- USB-Stick (attached and located inside the unit)



X Position of spare fuse

Y Position of USB stick

Fig. 56: Position of USB stick and spare fuse inside of unit

Starting the program:

1. Copy all supplied files via the Windows functions onto the USB stick, directly into the main directory.

Required files:

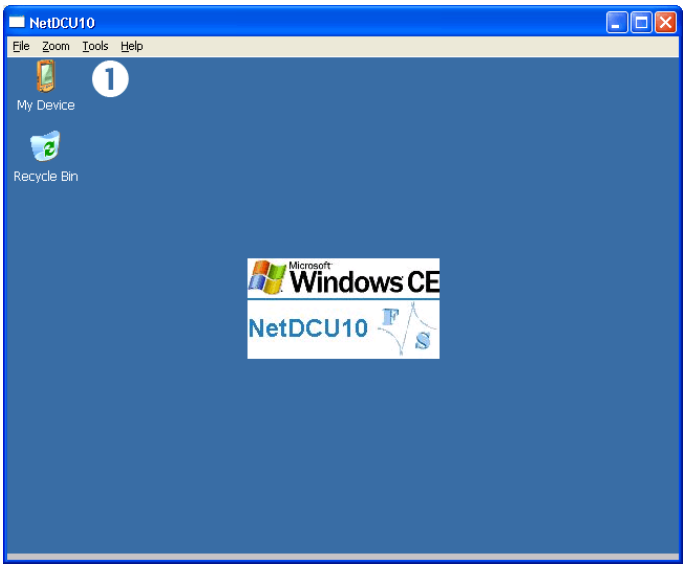
SND40_10Store.exe	application program for storing or restoring the SND40 data
SND40_10Storeenu.exe	same as SND40Store.exe, but in english
snd40_10.exe	application, newest version (all languages)
snd40_10.exe.0c0a.mui	language files in spanish
snd40_10.exe.040c.mui	language files in french
snd40_10.exe.0407.mui	language files in german
snd40_10.exe.0409.mui	language files in english
snd40_10.exe.0410.mui	language files in italian
snd40_10.exe.0416.mui	language files in portugese
programxx.cfg	customer specific settings for the application
system.cfg	system settings for SND40 applications
Freq.ini	initialization file containing the SND40 frequencies

Files for specific tasks:

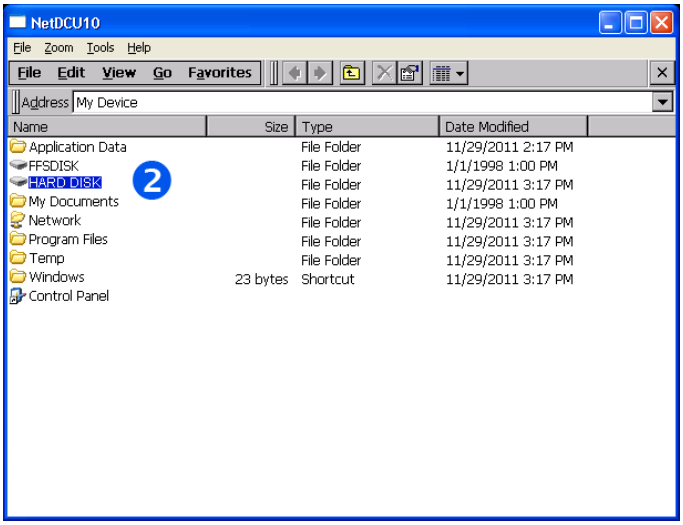
CERDisp.exe	program to display the application on an external PC
EDITOR.EXE	text editor program
USBPRN.DLL	USB host printer driver
PCL.dll	printer driver for emulating on a parallel port

2. Connect a USB stick at the front panel socket of the SND40.
3. Terminate application SND40 (activate on screen keyboard, *ESC* to confirm).

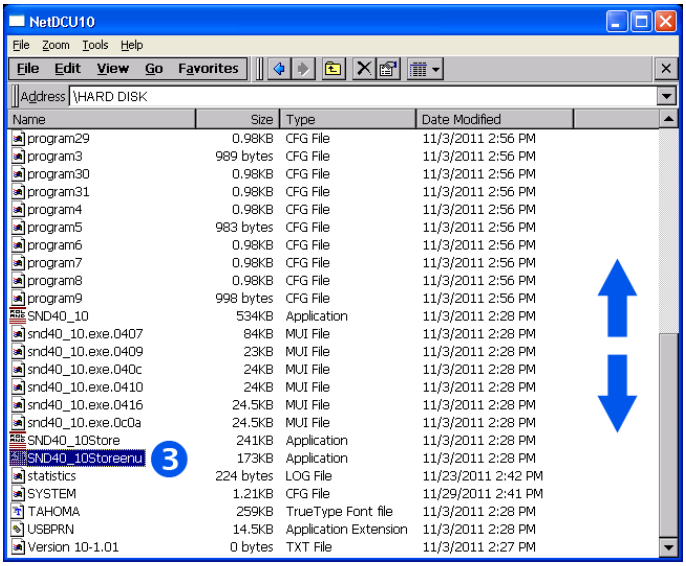
▶ **Note** The control unit recognizes the USB stick with some time delay.



SND40_10Store	
1:	Open the Windows Explorer by touching the “My Device” icon on the screen or by double click.

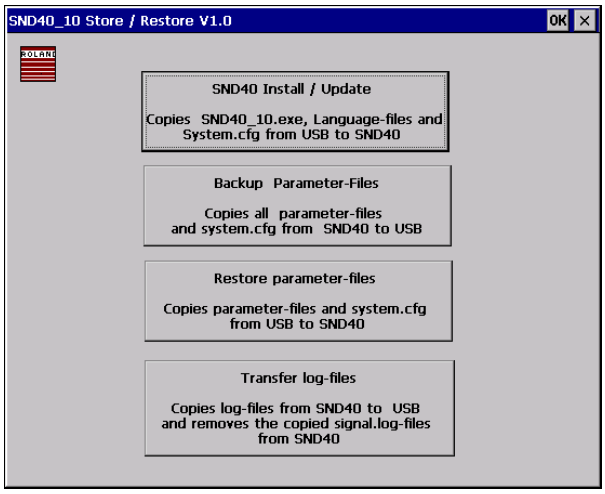


SND40_10Store	
2:	“HARD DISK” has to be chosen to get access to the data stored on the USB stick. Please press or double click to proceed.



SND40_10Store	
3:	You might scroll up or down until you get to “SND40_10Storeenu”. Please start the application by pressing or by double click.

Pressing the respective keys initiates different actions:



SND40 Install / Update Copies SND40_10.exe, Language-files and System.cfg from USB to SND40	**SND40 Install** Copies the provided version of the application program to the SND40. In this process all language depending files (*mui) and the system configuration file (“system.cfg”) are automatically copied.
Backup Parameter-Files Copies all parameter-files and system.cfg from SND40 to USB	**Backup Parameter-Files** Copies all existing program parameters files into the root directory of the USB stick. After all files were copied, an appropriate message appears.
Restore parameter-files Copies parameter-files and system.cfg from USB to SND40	**Restore parameter files** Copies all existing program parameter files from the root-directory of the USB stick to the SND40. After all files are copied, an appropriate message appears. If there is already a system file on the SND40, then the adjustments are kept. In case of a system update additional information can be present in the system file. Then default values are taken over for that additional information to the new file. Please check the system settings when starting the unit for the next time.
Transfer log-files Copies log-files from SND40 to USB and removes the copied signal.log-files from SND40	**Transfer log-files** Copies all existing log files (event file) into the root-directory of the USB stick. After all files were copied, an appropriate message appears. Simultaneously the log files are deleted from the SND40, releasing storage space.

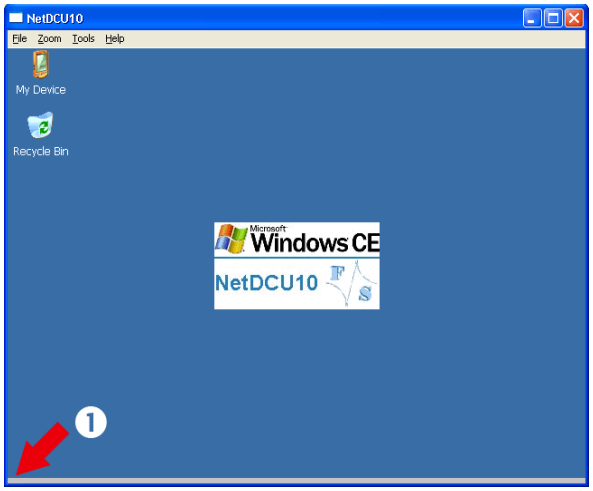
- After all intended actions were executed, terminate the program with the OK (“*OK*” key).
- For restarting the system briefly shut down power. At the start a system password is requested. This must be entered via the screen keyboard. It reads: *roland*.

Attention These steps should be performed by qualified personnel only!

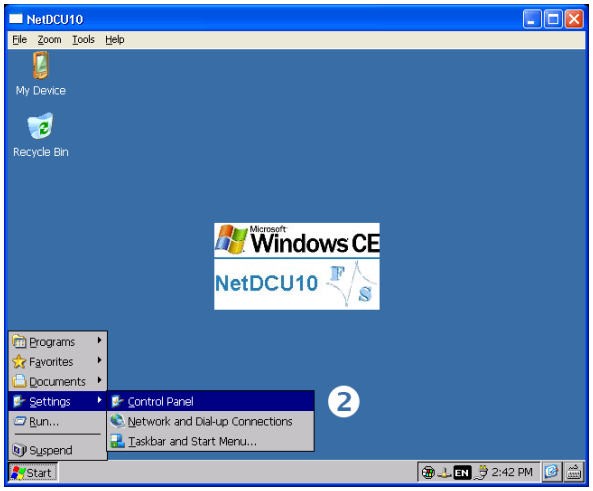
10.6 Setting the System Time / Date

The system time / date is a component of the Windows operating system, it is set in the system control as for every other PC with Windows OS.

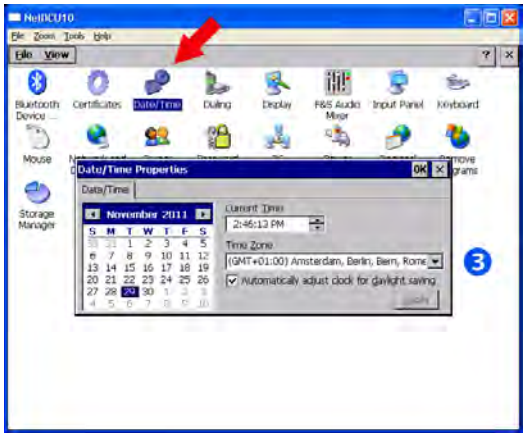
- Connect a USB keyboard (if available), otherwise use the touchscreen.
- Terminate the SND40 program (ESC key on screen keyboard), the Windows desktop then appears.



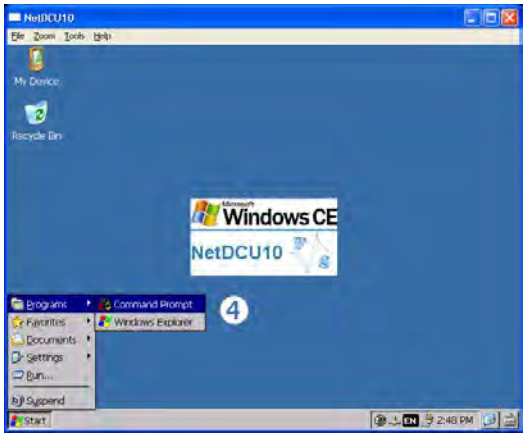
- Click in the left bottom corner of the screen to make the taskbar visible.



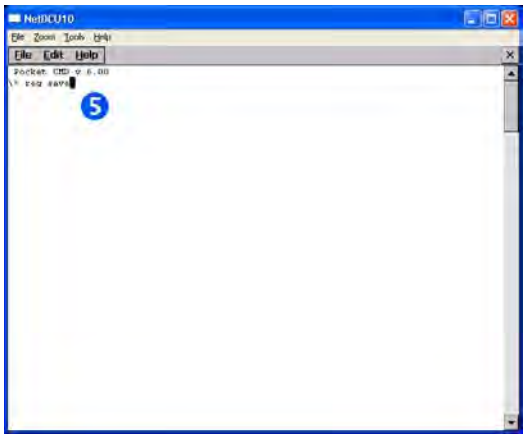
- In the Start menu, choose under „Settings“ the „Control Panel“.



- In the Control Panel press or click on the “Date/Time” icon.
- Change the system time / date (as for any other Windows PC).
- Clicking on the *Apply* key validates the changes.



- Go back to the Windows Desktop and choose in the Start menu under „Programs“ the „Command Prompt“.
- Enter: ndcucfg



- Please type „ > reg save“ und confirm with „Enter“ button.
- Re-start the system by recovering the supply voltage.

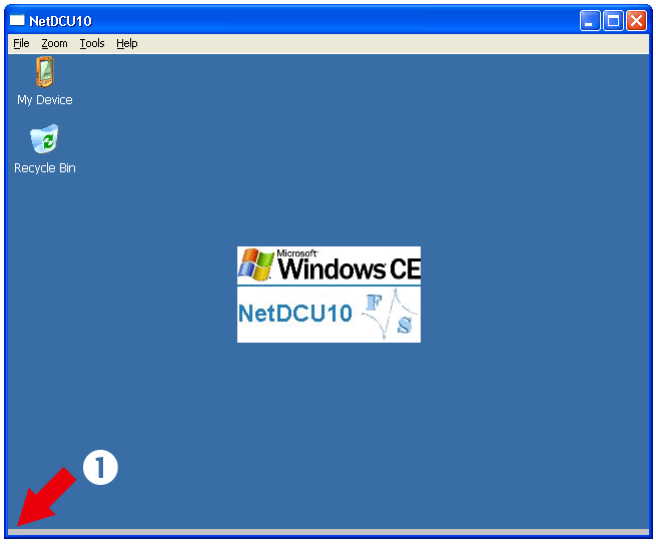
10.7 Calibrating the touchscreen

Method 1: Calibration via Remote connection

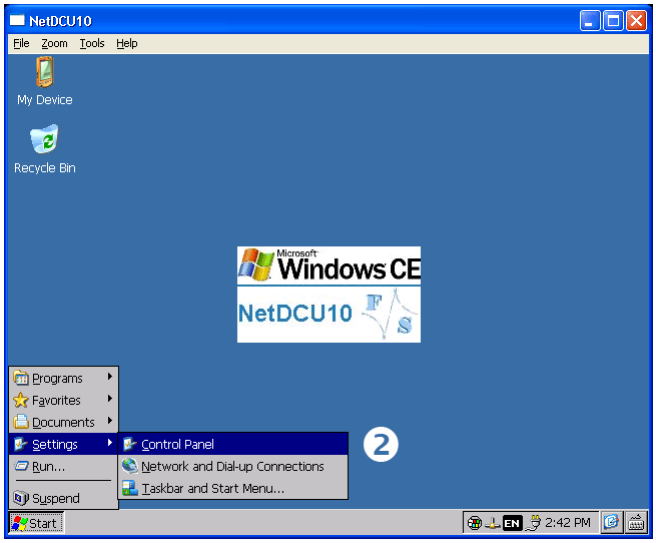
Note: Establishing a Remote connection is described in this manual, section “Service function Remote Desktop”.

Establishing a Telnet connection is also described in this manual, section “Data backup via network”, item 1 + 2.

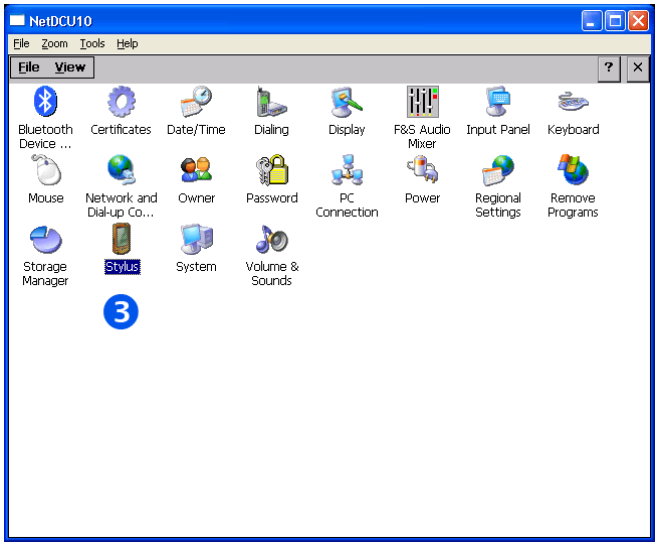
- At the PC establish Remote connection with Remote Desktop, so that the SND40 can be remote operated.
- Terminate SND40 program (ESC key).



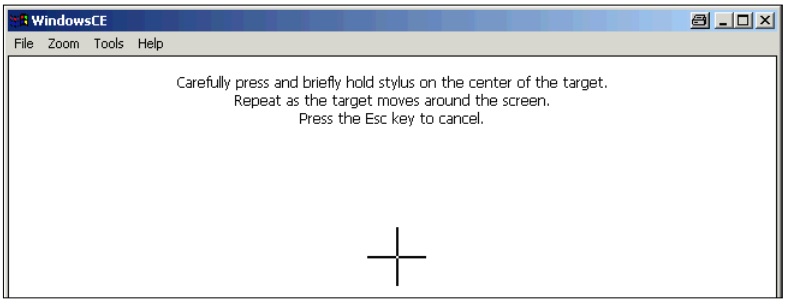
- Click in the left bottom corner to make the taskbar visible.



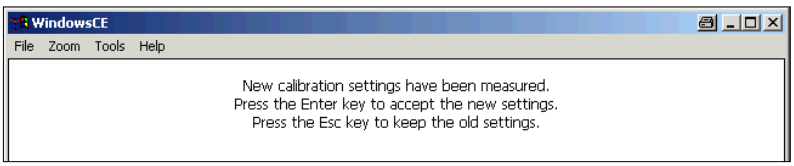
- In the Start menu, under „Settings“ choose the „Control Panel“.



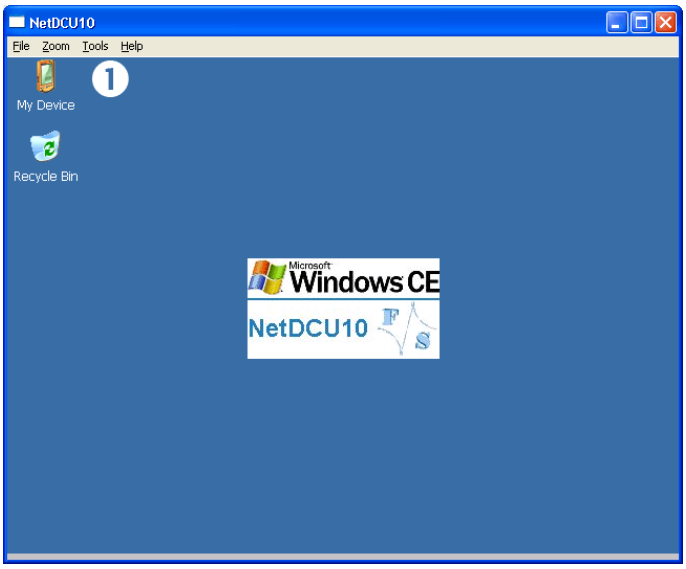
- In the Control Panel press, resp. click on the „Stylus“ icon.
- Click on the “Calibration” tab.
- Operate the “Recalibrate“ key.
- Calibrate the display according to the instructions.



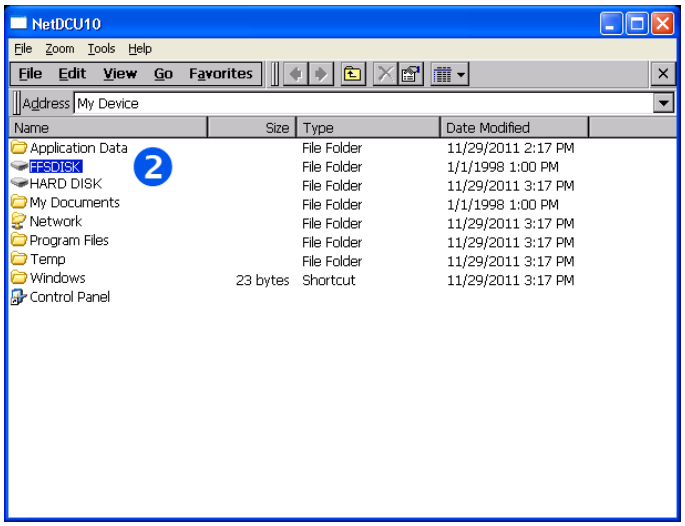
- After the calibration process close the calibration window and return to the start screen.



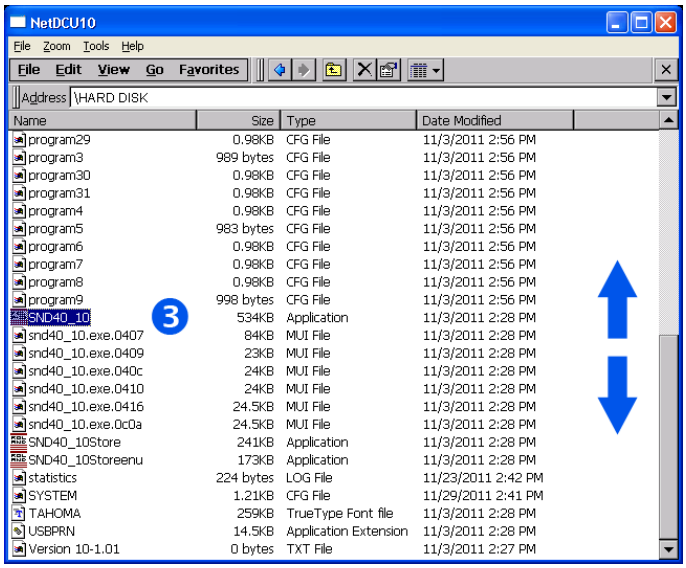
- Establish a Telnet connection.
- Enter: ndcucfg.
- Type the following commands and confirm each by pressing „Enter“:
  reg save
  quit
  The changes are now saved.
- Restart the application:



Start application SND40_10	
1:	Open the Windows Explorer by double click the icon “My Device”.



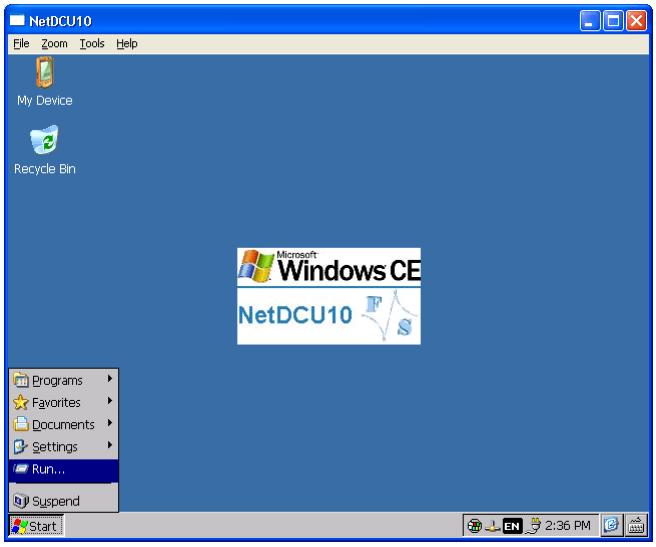
Start application SND40_10	
2:	Please execute “FFSDISK”.



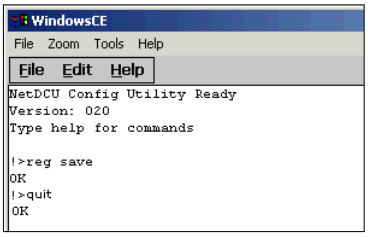
Start application SND40_10	
3:	Scroll until you find “SND40_10” and restart the application.

Method 2: Calibration without PC connection, but with a external USB keyboard

- Connect a USB keyboard.
- Terminate SND40 program (ESC key).
- The procedure in calibration without PC is almost identical.
  No Telnet connection is required. So proceed with the calibration as described in method 1.
- Instead of a USB keyboard you may also use a USB mouse.
- Finally, when you return to the start screen make the taskbar visible.



- Press "Run" and execute "cmd.exe".
- Enter: ndcucfg
- Type the following commands and confirm each by pressing „Enter“::
  reg save
  quit



The changes are now saved.

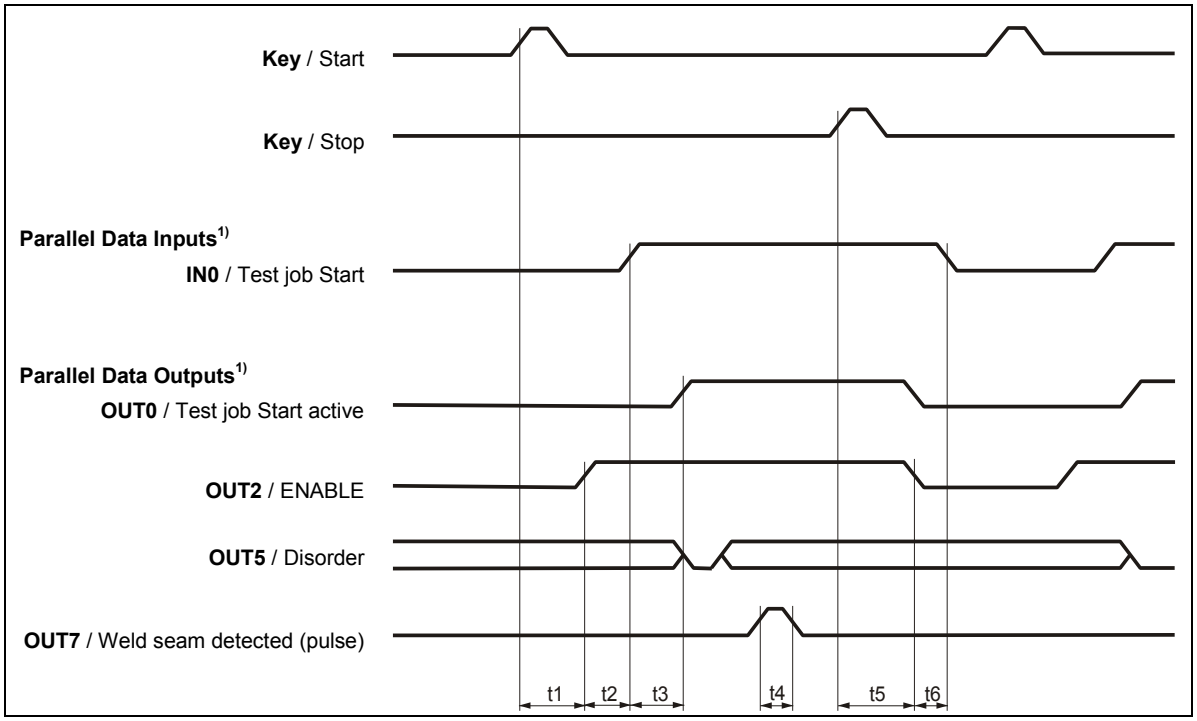
11 Technical records

11.1 Timing diagrams – Flat material application

Minimal wiring of interface
Operational condition: Teach-In - Edit

Pre-condition:

1. The unit must be in condition "*Teach-In – Edit*".
2. System parameter "*Controlling Test job: PLC*"
3. Test job / X/Y operation (started and ended with key)



t1: < 100 ms
t2: Time which the PLC requires to prepare the test job.
t3: < 30 ms
t4: > Weld seam holding time ((can be extended by switch-off delay).
t5: < System parameter "*time interval*"
t6: The end of the test job / X/Y operation will be determined by the user via key operation.

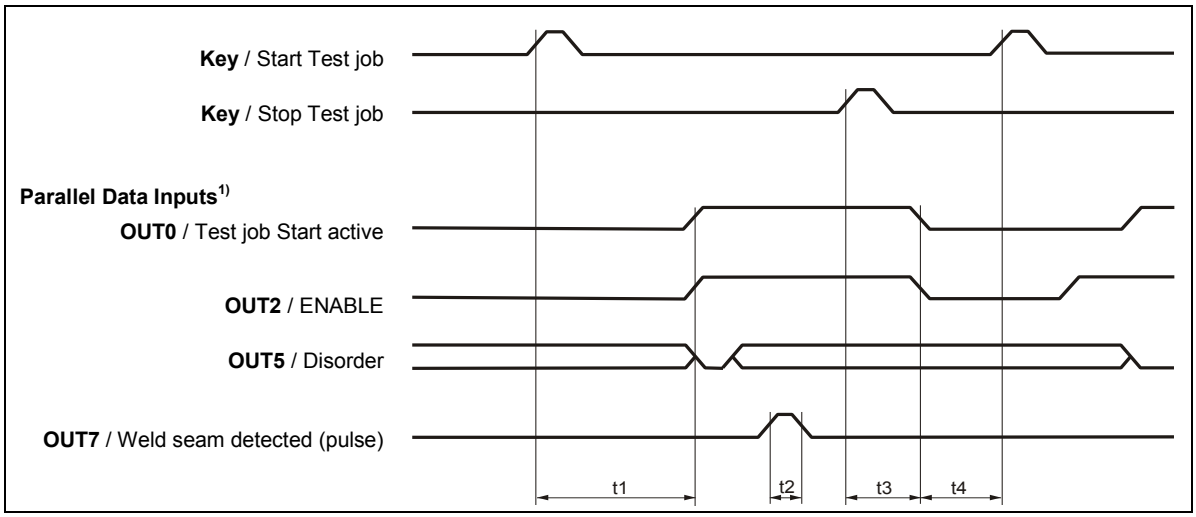
The total duration of the test job / X/Y operation will be determined by the user via key operation.

[1)] Not mentioned inputs / outputs of the interface are not required for parameter programming.

Minimal wiring of interface
Operational condition: Teach-In - Edit

Pre-condition:

1. The unit must be in condition "*Teach-In - Edit*".
2. System parameter "*Controlling test job: KM*" (with key at SND40)
3. Test job (started and ended with key)
4. The PLC must have prepared the test job.



t1: < 100 ms
t2: > Weld seam holding time (can be extended by switch-off delay).
t3: < System parameter "*time interval*"
t4: > 30 ms

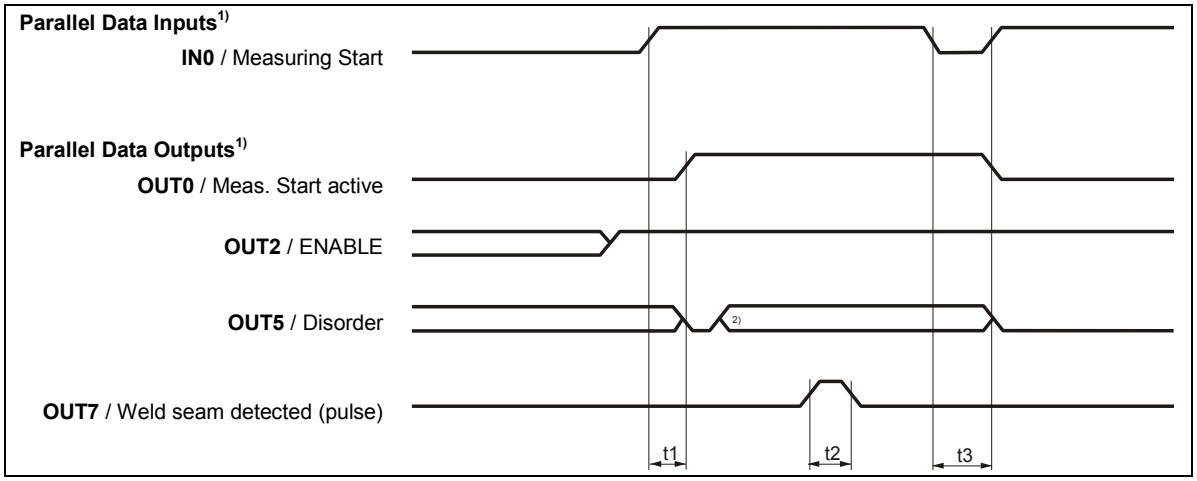
The total duration of the test job / X/Y operation will be determined by the user via key operation.

[1)] Not mentioned inputs / outputs of the interface are not required for parameter programming.

Standard wiring of interface
Measuring by external PLC

Note!

For externally triggering a measuring with IN0, a valid program must be selected (externally or via keyboard) and the unit must be in "*Automatic – Ready*" condition.



t1: < 30 ms
t2: > Weld seam holding time (can be extended by switch-off delay).
t3: < System parameter "*time interval*" (if shorter, then measuring will not be finished)

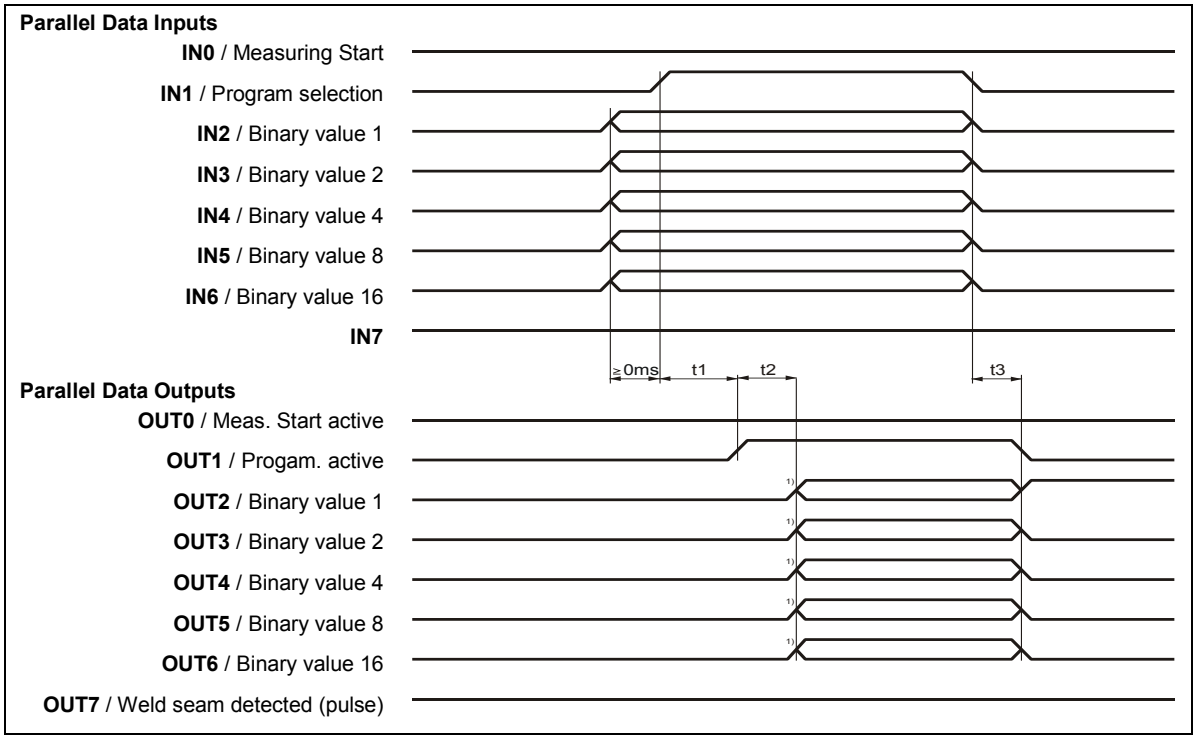
A disorder will be deleted by a new measuring.

1) Not mentioned inputs / outputs of the interface are not required for parameter programming.
2) A "HIGH" signal at output "disorder" signalizes that an error occurred while measuring.

Standard wiring of interface
Program selection by external PLC – Menu address binary coded

Note!

For the external program selection the unit must be in "*Automatic - Ready*" or "*Automatic program - disorder*" condition. When a program is selected without previous programming, enabling will not be performed and the input data IN2 to IN6 will not be mirrored at the outputs OUT2 to OUT6. On the display a note regarding the missing parameters will be shown.



IN0 and IN1 are flank triggered interrupt inputs. In the standard configuration the positive flank is active. Both inputs must not be activated simultaneously. The min. time between 2 commands must be >20 ms. IN1 is the strobe input for the data inputs IN2 to IN6.

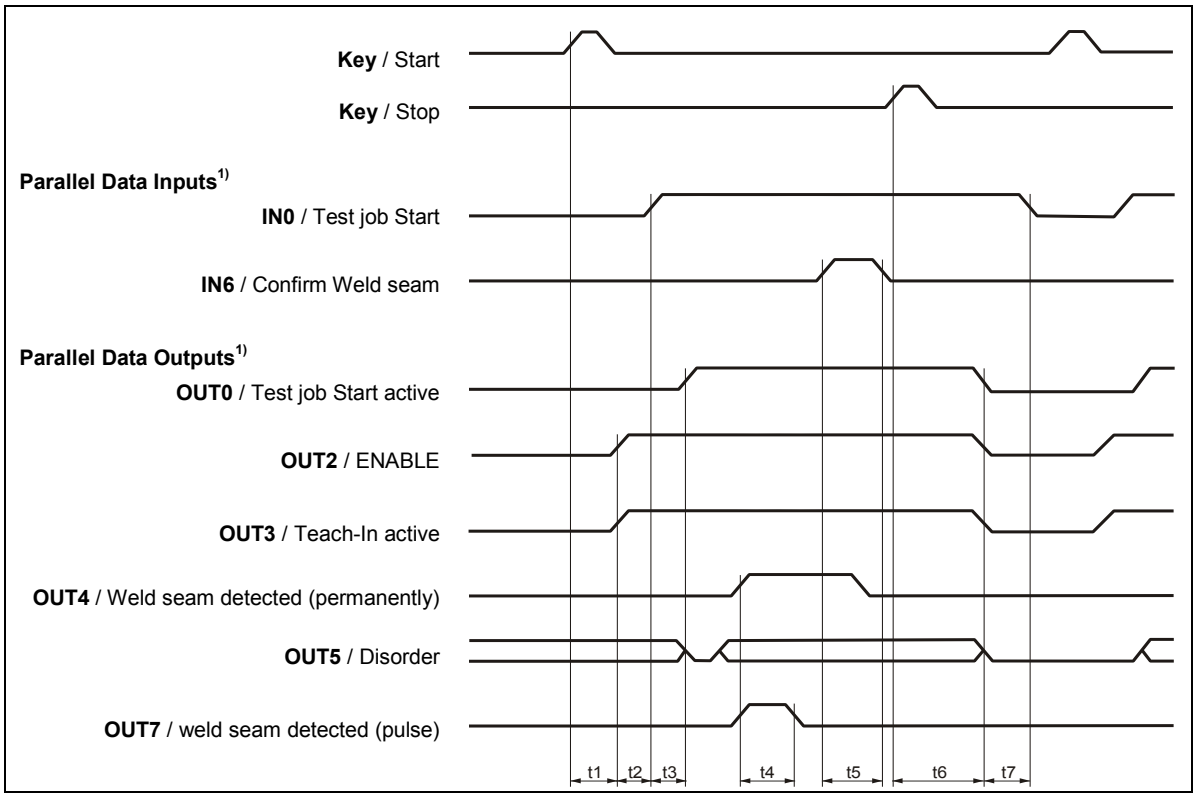
t1: < 20 ms
t2: < 200 ms
t3: < 5 ms

[1] The output signals OUT2 to OUT6 have two different functions. On externally activating the command "*Program selection IN1*" the input data IN2 to IN6 are mirrored at the outputs OUT2 to OUT6, in order to enable transmission monitoring. On externally activating the command "*Measuring Start IN0*" the measuring result and status messages will be reported. In the standard configuration High Level = active.

Standard wiring of interface
Operational condition: Teach-In - Edit

Pre-condition:

1. The unit must be in "*Teach-In – Edit*" condition.
2. System parameter "*Controlling test job: PLC*"
3. Test job / X/Y operation (started and ended with key)



t1: < 100 ms
t2: Time which the PLC requires to prepare a flat material for parameter programming.
t3: < 30 ms
t4: > Weld seam holding time (can be extended by switch-off delay).
t5: ≥ 30 ms
t6: < System parameter "time interval" (if shorter, then measuring will not be finished)
t7: At the end of the test job / X/Y operation the start signal must be cancelled.

The Teach-In will be terminated at the unit by the user (ENABLE Low level)

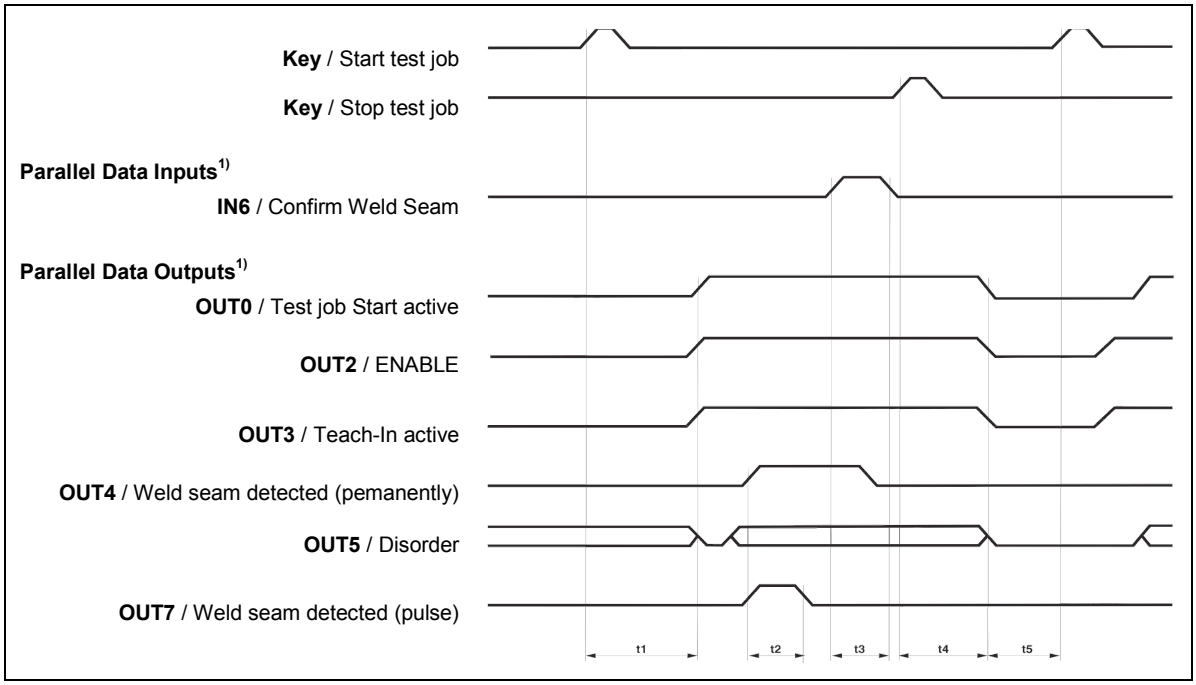
[1)] Not mentioned inputs / outputs of the interface are not required for parameter programming.

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

Standard wiring of interface
Operational condition: Teach-In - Edit

Pre-condition:

1. The unit must be in "*Teach-In - Edit*" condition.
2. System parameter „*Controlling test job: KM*"(with key at SND40)
3. Test job (started and ended with key)
4. The PLC must have prepared the test job.



t1: < 100 ms
t2: > Weld seam holding time (can be extended by switch-off delay).
t3: ≥ 30 ms
t4: < System parameter "*time interval*" (if shorter, then measuring will not be finished)
t5: > 30 ms

The Teach-In will be terminated at the unit by the user (ENABLE Low level)

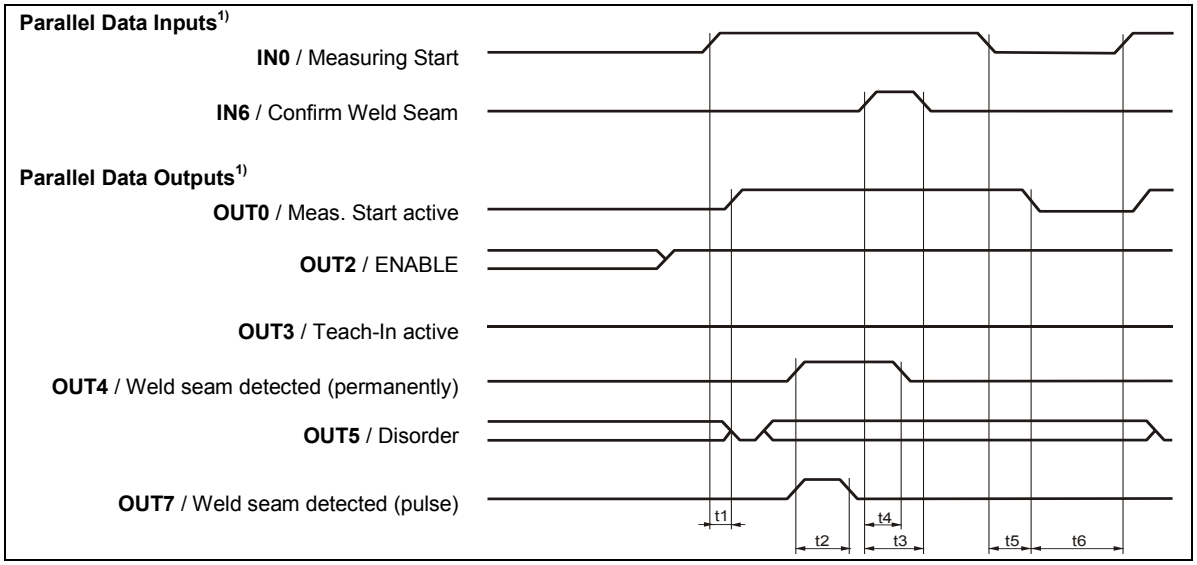
[1)] Not mentioned inputs / outputs of the interface are not required for parameter programming.

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

Standard wiring of interface
Measuring procedure by external PLC

Note!

For the external triggering of a measuring with IN0, a valid program must be selected (externally or via keyboard) and the unit must be in ”*Automatic - Ready*” condition.



t1: < 20 ms
t2: > Weld seam holding time (can be extended by switch-off delay).
t3: ≥ 30 ms
t4: < 30 ms
t5: < System parameter ”time interval“
t6: ≥ 30 ms

The Teach-In will be terminated at the unit by the user (ENABLE Low level)

1) Not mentioned inputs / outputs of the interface are not required for parameter programming.

The output OUT4 "Weld seam detected (permanent) is only activated in the system configuration at acknowledge mode.

11.2 Service

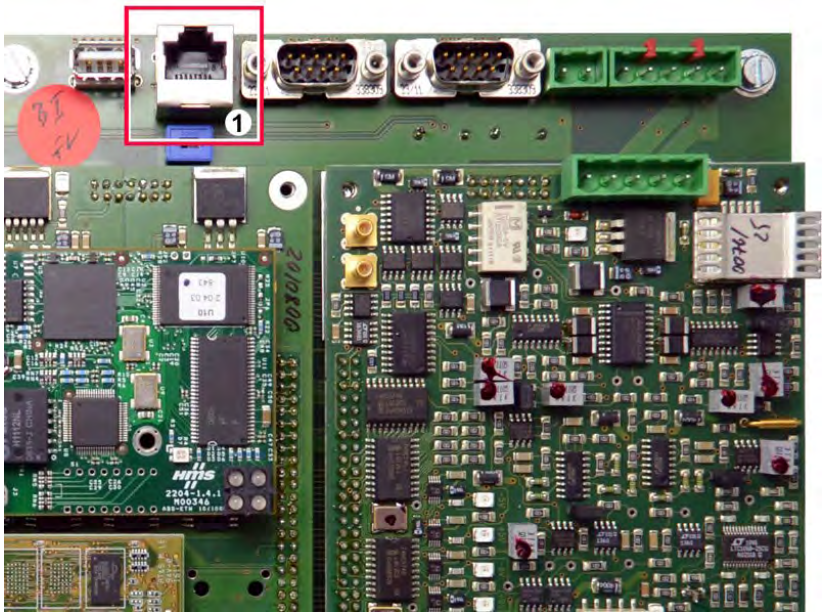
11.2.1 Service function “Remote Desktop”

For monitoring and remote controlling, the operator surface of the SND40 can be visualized on another PC.

Attention! The Remote Desktop connection itself as well as the connection of the network cable claims computing capacity!

This can result in cancelling of the measurement operation (error message “Data transfer too slow”).

For directly connecting the unit to a Laptop or a Host PC a cross-over network cable is required. On practically all the current laptops and PCs, a normal network cable can be used, as these devices Auto MDI-X are capable and accept the crossing of the wires.



The connection is made inside the unit.	
1:	RJ45 socket

Fig. 57: Remote Desktop connection

Further prerequisites:

1. On the Host-PC the permanent IPV4 address 192.168.100.222 with the sub net mask 255.255.255.0 must be allocated. This can also be found in the registry of the SND40. If it should be necessary to set another address in the Host-PC, please contact Roland Electronic.

2. The file ”*rhost.exe*“ must be present on the Host-PC. The program rchost.exe must be approved in the Windows Firewall. See "Allow rhost.exe in Windows Firewall".

3. On the Host-PC the Windows function Telnet Client must be activated. See “Activate Telnet Client” for details.

Settings on delivery:

IP-Adresse SND40:	192.168.100.107
SubnetMask:	255.255.255.000
IP-Adresse für Remotedesktop:	192.168.100.222

Characters within ” “ must be typed in, within < > the designations of keys or buttons are shown.

How to establish the remote connection:

1. Start "*rhost.exe*" on the Host-PC.
2. Start a *Telnet* session on the Host-PC (towards the SND40):
   - Start the windows command shell and enter the command "cmd".
   - Type "`telnet 192.168.100.107`" and confirm with <*ENTER*>.
   - Type "`cerdisp -c`" and confirm with *ENTER*.

Script for easy establishing a connection:
On the Roland website http://roland-electronic.com/en/service/software there is a script to download, which starts the connection by double click on the unzipped file.

11.2.1.1 Allow rhost.exe in the Windows Firewall

When starting rhost.exe for the first time, this message will appear on new Windows systems:

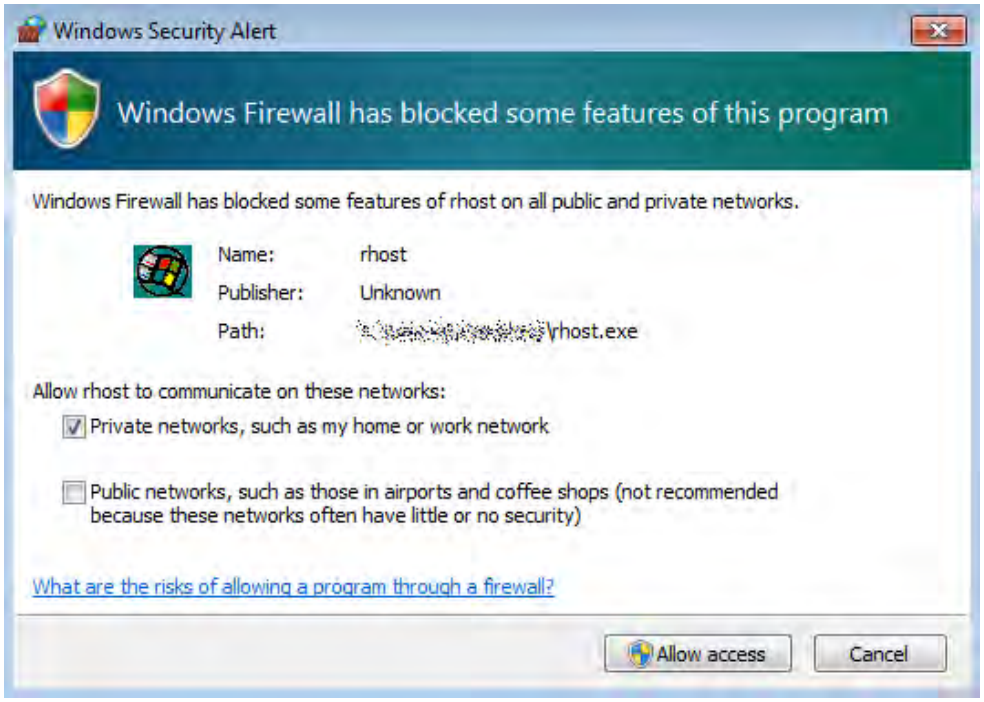


Fig. 58: Allow program rhost.exe in the Windows Firewall

Allow the program in Home and workplace networks at this point.

11.2.1.2 Activate the Telnet Client

If the following message is displayed in the Windows command prompt, the function must be activated in Windows (generally staring from Windows Vista):

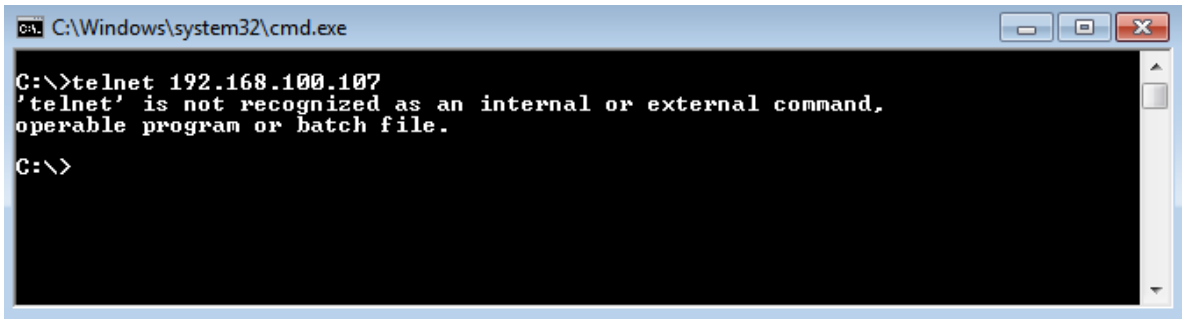


Fig. 59: Activate the Telnet Client

The activation of the Telnet Client must be performed here:

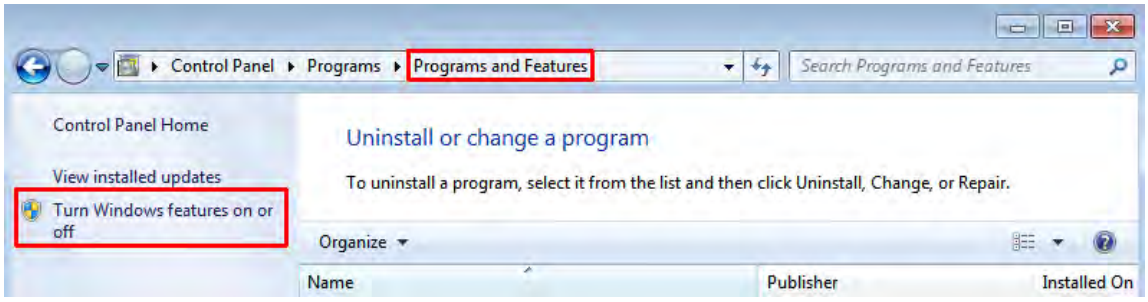


Fig. 60: Activate the Windows function Telnet-Client step1

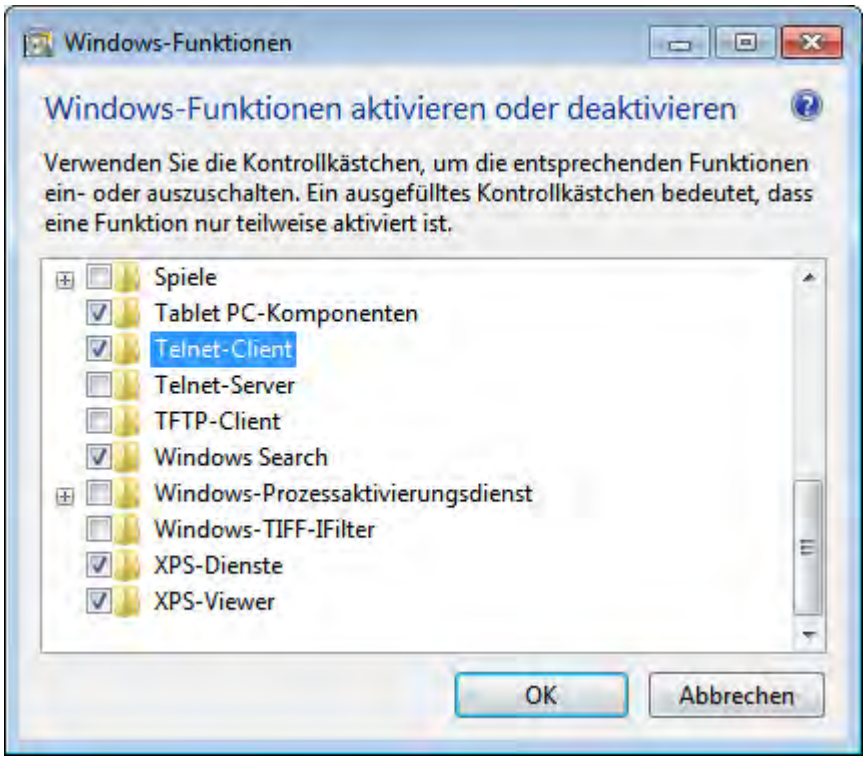


Fig. 61: Activate the Windows function Telnet-Client step 2

11.2.2 Data backup via network

Data backup can be done via Ethernet or by USB interface (for newer hardware).

Data backup via Ethernet is performed within a *Telnet* session.

Note: For the term "*Host-PC-name*" used in this section, the respective Windows name of the PC must be inserted. The PC name can be found via "*my computer*" -> "*properties*" -> "*computer name*".

1. Create a new folder, e.g. „*SND40-backup*" on the Host PC, which permits full access with the access name „*netdcu*".
2. Start a *Telnet* session on the Host PC (towards SND40).

   Therefore:

   - Open the command prompt (Start > Run) and enter "*CMD*" and confirm with <ENTER>.
   - Enter "*telnet 192.168.100.107*" and confirm with <ENTER>.
3. Copy data:

   Generally: Always copy data from / to folder "*ffsdisk*" on the SND40.

   Copy files from the SND40 to the Host PC:

   - Enter "*cd \ffsdisk*" and confirm with <ENTER>.
   - Enter "*copy *.cfg \\Host-PC-name\netdcu*" and confirm with <ENTER> (this will copy the program files and the system settings).
   - Enter "*copy statistics.log \\Host-PC-name\netdcu*" and confirm with <ENTER> (this will copy the Log files).
   - Now all files should be reported as copied.
   - For verification enter "*dir*" and confirm with <ENTER>. All files in the directory will be shown. Verify if all files have been copied.

   Copy files from the HOST PC to the SND40:

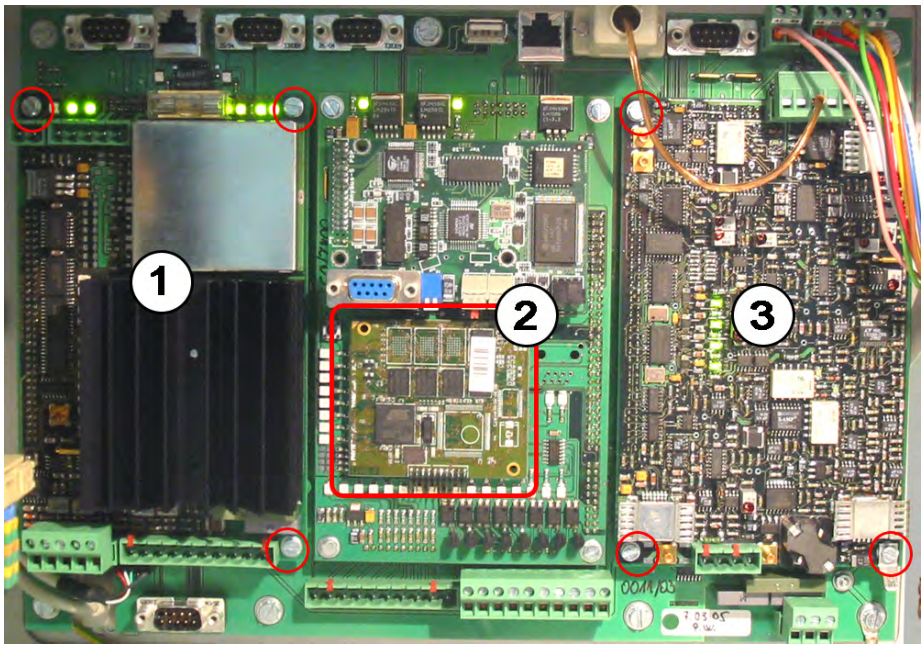
   Attention! The files on the SND40 will be overwritten without further notice !!!

   - Enter "*cd \ffsdisk*" and confirm with <ENTER>.
   - Enter "*copy \\"Host-PC-name"\netdcu*.**" and confirm with <ENTER>.
   - Now all files should be reported as copied.
   - For verification enter "*dir*" and confirm with <ENTER>. All files in the directory will be shown. Verify if all files have been copied.

Data backup via USB stick is performed by the enclosed software "*SND40Store*". For details read "*SND40 Store*" in chapter "*maintenance and repair*". When using newer hardware, backup via USB stick should be preferred.

11.2.3 Exchanging components and retrofitting

- Disconnect the unit from mains net before performing works on the unit.
- Discharge yourself to ground before touching electronic components. Otherwise components could be damaged due to electrostatic charges.



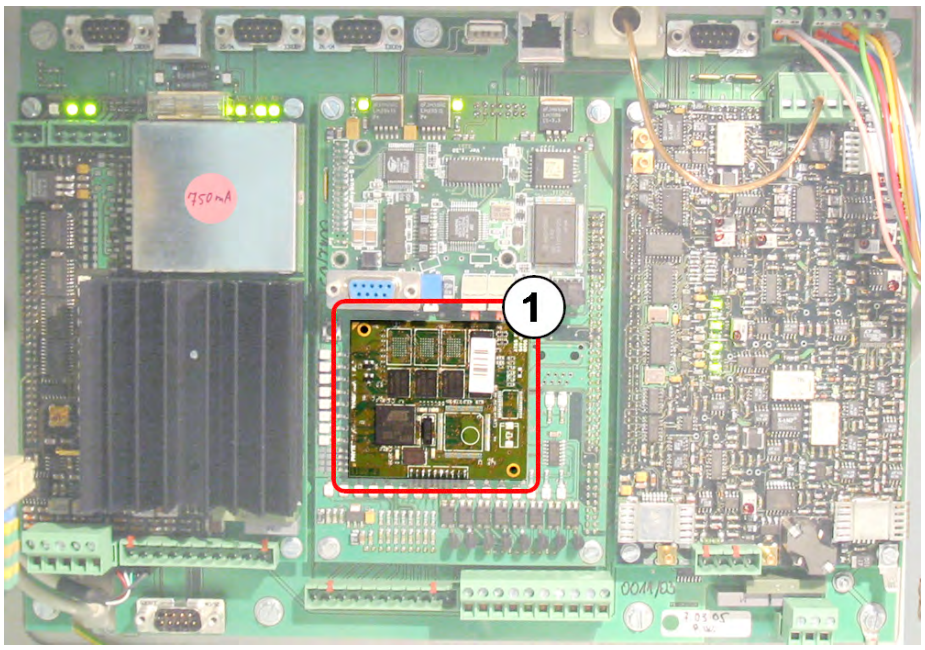
Typical delivery condition of a SND40 combination unit	
1:	Leakage flux module
2:	Processor module
3:	Eddy current module

Fig. 62: Delivery condition

Required tools and material:

- Mid-size screw driver
- Screw driver with hexagon insert, size 5,5 for M3
- 4 spacer bolts M3

11.2.3.1 Exchanging the processor module

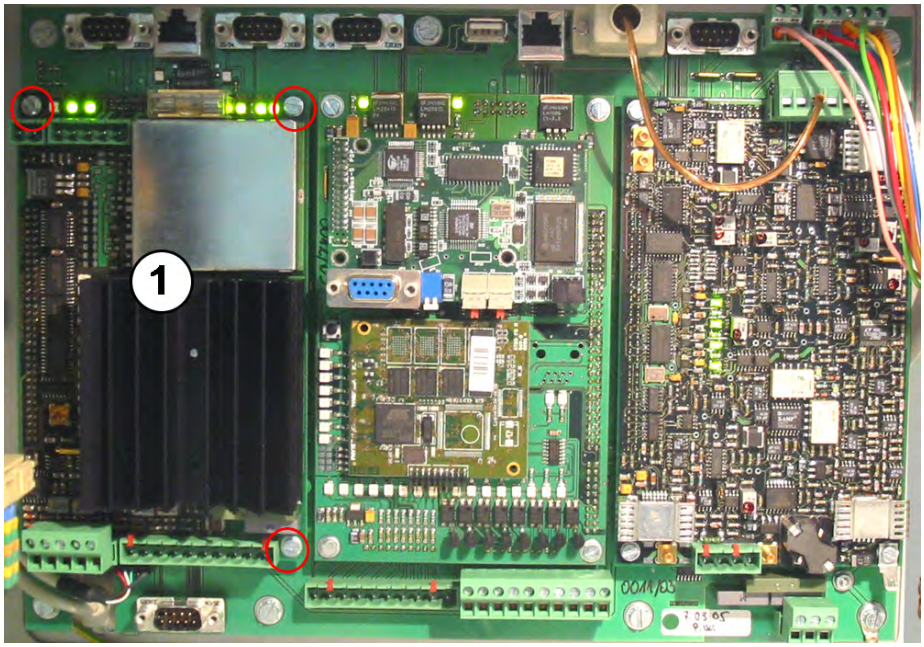


Change of components	
1:	Processor module

Fig. 63: Exchanging the processor module

- Remove the module carefully. Grab the module with both hands (index finger and middle finger) and carefully lift the module off its socket.
- Insert the new module with the same orientation. The pin strip always points towards the unit floor.
- Before inserting the module into the socket, take care that on both sides plugs and sockets match.

11.2.3.2 Exchanging the leakage flux module

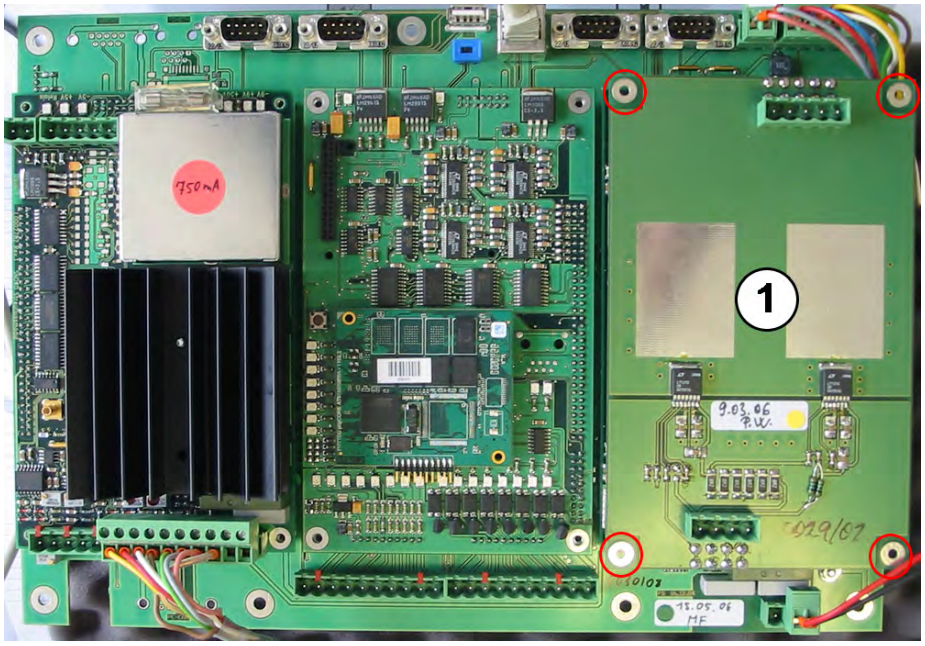


Change of components	
1:	Leakage flux module

Fig. 64: Exchanging the leakage flux module

- Loosen all cable plugs and the 4 fixing screws.
  Every screw connection consists of an M3 screw, a toothed washer and a flat washer.
- Do not lose any parts, danger of short-circuit.
- Carefully pull the module at the upper and lower side, in order to loosen it from its socket.
- Insert the modified leakage flux module with the same orientation into the socket.
- If the module has been correctly inserted, the fixing holes and the holes of the support bolts match.
- Re-fasten the module with the screws and put-on the cable plugs again.

11.2.3.3 Retro-fitting the cable driver module



Retrofit	
1:	Cable driver module

Fig. 65: Retro-fitting the cable driver module

- Loosen all cable plugs and the 4 fixing screws.
  Every screw connection consists of an M3 screw, a toothed washer and a flat washer.
- Do not lose any parts, danger of short-circuit.
- **Note:** Older units are equipped with a flat plug at the lower right screw joint.
  Do not forget this when mounting the driver module.
- Replace every screw by one of the provided spacer bolt.
- Plug-on the cable driver module.
  Take care that every connector at the module gets into the corresponding contact on the eddy current module.
- Fasten the module with the remaining screws.
- For older units: re-attach the flat plug for the shielding connection.
- Re-plug all cables onto the cable driver module.

11.3 Hints on Hardware and Software versions

Index of changes

Communication module	
KM V1.15 04.04.2006	Introduction: Cancelling on entering password is possible Introduction: Printing the system settings without change mode is possible Introduction: Filter „SAF“ “*SAF*” stands for “*Signal Activity Filter*“, representing the filter function more correctly. Introduction: Bus error message (Fieldbus): “*Bus transfer disturbed*” Introduction: Y stretching limited 1…10 *Only in combination with PM V12 or later*
KM V1.16 28.07.2006	Introduction: Automatic restart after changing of settings. (from serial number 400059). *(if restart required)*
KM V1.17 12.04.2007	Introduction: Round specimen: Visualization of weld seam width in graphics. Introduction: Flat specimen: Visualization of both limits at filter „bipolar“. Introduction: Transmission of signal-noise ratio in dB (up to 34 dB) and visualization in log files Change: StartUp fault; „24V voltage fault“ redressed.
KM V1.18 13.07.2007	Change: Signal-noise ratio extended to 40dB resp. >40dB *Only in combination with PM V14 or later*
KM V1.19 30.07.2007	Change: SnlogFile extended to 14 days. Change: Storing fault messages of PM in SNLogFile.
KM V1.20 27.10.2007	Introduction: New language: Portuguese, new MUI file:„SND40.exe.0416.mui“. Introduction: New SND40Store software
KM V1.21 09.01.2008	Introduction: New language: Spanish, new MUI file: „SND40.exe.0c0a.mui“.
KM V2.04 19.09.2008	Introduction: Extension French + Optimizer + 99 Programs.
KM V2.05 25.02.2009	Optimizer locked 31 Prog.
KM V2.06 09.12.2009	Optimizer free 31 Prog. Error: Memory problems existing!!
KM V2.07 07.01.2010	Memory problem fixed
KM V2.08 03.07.2012	On old mainboards also showing message „please restart“
KM V1.21 09.01.2008	Introduction: New language: Spanish new MUI-file: „SND40.exe.0c0a.mui“.
KM V10-1.00 25.04.2010	For SND40 units with NETDCU 10 (Defective version on round objects)
KM V10-1.01 10.10.2010	For SND40 units with NETDCU 10 (Defective version on round objects)
KM V10-1.03 17.01.2012	For SND40 units with NETDCU 10 (Defective version on round objects fixed)
KM V10-1.04 09.07.2012	For SND40 units with NETDCU 10 Added on param. „detection quality“: extra + ultra
KM V10-1.05 01.01.2016	For SND40 units with NETDCU 10 + NETDCU A5: New language Russian
KM V10-1.06 01.01.2016	For SND40 units with NETDCU 10 + NETDCU A5

Processor module	
PM V12 04.04.2006	Change: SAF filter: more firmly specified (old: 8/4/1,5; new:16/8;3) for teach-in. *This filter is preferably used since being introduced. With the old settings the filter showed results "good" to "very good" even with weak seam signals. Thus tubes with unsuitable seam signal were falsely declared practicable. The new settings prevent from such mis-interpretations.* Introduction: Bus interface Profibus Introduction: PLC interface additional input „Reset Fault " *Was introduced in order to permit the PLC to reset a fault condition.*
PM V13 19.03.2007	Change: Digital filter in mode „Flat specimen" extended by „bipolar". ATTENTION! The allocation of the digital output signals for „bipolar" and „Flat" deviates from the standard. Introduction: Signal-noise ratio
PM V14 13.07.2007	Change: Signal-noise ratio extended to 40dB resp. >40dB
PM V15 20.10.2008	Introduction Profinet (errors)
PM V18 01.05.2009	Introduction Profinet (error-free)
PM V19 28.01.2010	Works well with new leakage flux module and with old module; for NETDCU 10 too
PM V20 15.04.2011	Same as V19 + Error magnetic field on start-up fixed
PM V21 08.09.2011	Error message „Fan defect" ,error fixe on old leakage flux module
PM V22 24.04.2012	New Profibus modules utilizable
PM V23 18.02.2014	Detection of speed measurement: Increasing to 2000 values for one tube turn. (previously 500 values for one tube turn) Slippage: Minimum adjustability 0,1 % (previously 1%) Sample rate: maximal 120 (previously 30) Internal signal type calculation: 8 kHz (previously 2 kHz)
PM V24 01.01.2016	Adaptation to NETDCU A5; also suited for NETDCU 10

Delivery only with leak flux module 750mA

In combination units and leak flux units following the serial number 400052 (mid-April 2006) the leak flux module 750 mA will be used.
Exception: Units with / for coil seam sensors NS9…EC.

Note for units with cable driver

Attention!

For units with cable driver module, please consider the following:

- Reduce the output voltage when using the cable driver:
- 0…25KHz = 20 Vss (no reduction)
- 50…100 KHz = 17 Vss
- 400…800 KHz = 5 Vss

11.4 Other informations

Evaluation criteria for round material

Setup mode		
Message	Signal-to-noise ratio	For filter SAF following: PM version V12 KM version 1.15
very good	>18dB (>8:1)	>24dB (>16:1)
good	>12dB (>4:1)	>18dB (>8:1)
satisfactory	>3,5dB (>1,5:1)	>9,5dB (>3:1)
not possible	<=3,5dB (<=1,5:1)	<=9,5dB (<=3:1)

Detection grade for round material

Automatic mode	
Detection grade	Signal-to-noise ratio
ultra	>18dB (> 8:1)
extra	>12dB (> 4:1)
very good	>6dB (> 2:1)
good	>2,5dB (> 1,33:1)
satisfactory	>1,1dB (> 1,14:1)

Typical gain values for NS9/12-EC…NT10-100-S sensors

Frequency	AC gain
6kHz	44dB
12 kHz	38dB
25 kHz	32dB
50 kHz	26dB
100 kHz	20dB
400 kHz	26dB
800 kHz	32dB

12 Order data

12.1 Control units

Ordering Designation	Comment
SND40-EC-IO	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems. Controlling via I/O interface
SND40-EC-PR	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems. Controlling via Profibus interface
SND40-EC-PN	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems. Controlling via ProfiNet IO interface
SND40-MF-IO	Unit for Leakage flux sensors. Controlling via I/O interface
SND40-MF-PR	Unit for Leakage flux sensors. Controlling via Profibus interface
SND40-MF-PN	Unit for Leakage flux sensors. Controlling via ProfiNet IO interface
SND40-EC-MF-IO	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems, Leakage flux sensors, Combination sensors. Controlling via I/O interface
SND40-EC-MF-PR	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems, Leakage flux sensors, Combination sensors. Controlling via Profibus interface
SND40-EC-MF-PN	Unit for Eddy current sensors, Eddy current probes, Encircling coil systems, Leakage flux sensors, Combination sensors. Controlling via ProfiNet IO interface

12.2 Sensors

12.2.1 Combo sensors

Combo sensors F-Type

Order designation	Comment
NS9-EC8x35NF10-100-SC KOMPLETT	Set consisting of: 1 pc. sensor NS9-EC8x35NF10-100-SC for FE / NF coils; min. coil width 100 mm 1 pc. roll support 6 pcs. rubber buffer (2299700)
NS9-EC8x35NF10-100-SC	Sensor (spare part) für FE / NF coils; min. coil width 100 mm

Combo sensors T-Type

Order designation	Comment
NS9-EC8x35NT10-100-SC KOMPLETT	Set consisting of: 1 pc. sensor NS9-EC8x35NT10-100-SC for FE / NF coils; min. coil width 100 mm 1 pc. roll support 6 pcs. rubber buffer (2299700)
NS9-EC8x35NT10-100-SC	Sensor (spare part) für FE / NF coils; min. coil width 100 mm

12.2.2 Eddy current sensors

Eddy current sensors T-Type

Order designation	Comment
NS9NH-EC6x24NT10-100-SC KOMPLETT	Set consisting of: 1 pc. sensor NS9NH-EC6x24NT10-100-SC for NF coils; min. coil width 100 mm 1 pc. roll support 1 pc. rubber buffer (2299700)
NS9NH-EC6x24NT10-100-SC	Sensor (spare part) für NF coils; min. coil width 100 mm

12.2.3 Transit coils sensors

Order designation	Comment
EC5x25IDN50-500-S KOMPLETT	Transit coil system for cables and wires (cross seams); diameter up to max. 4 mm
EC13x25PDN50-500-S KOMPLETT	Transit coil system for cables and wires (cross seams); diameter up to max. 12 mm
EC20x25IDN50-500-S KOMPLETT	Transit coil system for cables and wires (cross seams); diameter up to max. 16 mm

12.3 Cables / Accessories

Order designation	Comment
KNS9S-G	Cable for connecting the combo and leakage flux sensors to the control unit, with straight cable socket, standard length 5 m, max. 25 m*
KNS9S-W	Cable for connecting the combo and leakage flux sensors to the control unit, with angular cable socket, standard length 5 m, max. 25 m*
CECM18S-G	Cable for connecting the combo and eddy current sensors to the control unit, standard length 5 m, max. 20 m*
SKN8S	Cable for connecting the combo and leakage flux sensors to the Sensor Switch Box, with straight cable socket, standard length 5 m, max. 20 m*
SM18CECM18S-GG	Cable for connecting the combo and eddy current sensors to the Sensor Switch Box, with straight cable socket and cable plug, standard length 5 m, max. 15 m*
SM18CECM18S-GG-TA	Extension cable for sensor cable SM18CECM18S-GG respectively CECM18S-G, max. 15 m*
SSB-SND40	Sensor Switch Box for connecting 2 sensors
SCB-EC-S	Sensor Connection Box for connecting the eddy current probes
STUETZSCHUH	Support roller block as counter-bearing
2299700	1 pcs. rubber buffer
2390924	1 pcs. ball bearing 9x24x7 mm; for pole shoe NS9
2390822	1 pcs. ball bearing 8x22x7 mm; for sensor element NS9
2391005	Rollers, Polyurethane, Ø 55 mm; for sensors and STUETZSCHUH

*The total maximum cable length, especially when using the Sensor Switch Box must **not** be exceeded!

13 Appendix

13.1 Checklist for fault identification

Use the following checklist for identifying fault conditions.

Problem Classification	X	Please tick appropriate description	
		No operation / No start of tube turning device	
		Absolutely no weld seam detection	
		No. of non-detected weld seams too high	
		Wrong weld seam position with constant offset	
		Wrong weld seam position with permanently changing positioning	
		This problem occurs in _____ cases of _____ processed tubes/coils/drums	
Problem detected	**#**	**Possible Reason**	**Checked**
No operation / No start of tube turning device	1	Error found in SND40, see error message displayed, see manual for further information	
	2	Attached PLC does not function correctly	
	3	Cabling to PLC interrupted / disturbed	
	4	Problem of drive	
- Absolutely no weld seam detection - No. of non-detected weld seams too high - Wrong weld seam position with permanently changing positioning	5	Active Program does not match to the tube / coil to be detected.	
	6	Active Program has been modified with parameters not fitting to this tube	
- No. of non-detected weld seams too high - Wrong weld seam position with permanently changing positioning	7	Velocity or rotational speed differs from the settings in the program. Check this with function “Speed Measurement”	
	8	Velocity or rotational speed is not constant due to: - problems with drive control, - bad transmission of power from drive to tube, - reduced friction due to oil or dirt	
	9	Too strong or too weak pressing force of sensor onto tube, e.g. due to incorrect pressure of air cylinder	
	10	Not all rollers at sensor tip touch the tube due to: - incorrect mounting of sensor - Insufficient elasticity in sensor mounting (rubber mounts not used ?)	
	11	Accumulation of dust and dirt (e.g. metal particles) at sensor tip. Clean sensor regularly according to operating conditions. (Check at least every week)	
Problem detected	**#**	**Possible Reason**	**Checked**
- No. of non-detected weld seams too high - Wrong weld seam position with permanently changing positioning	12	Cabling problems: - Plugs loose - Bad grounding - Cable to close to high current cables or other equipment emitting electrical noise	
	13	Wear of ball bearings or pole shoes (see manual)	
	14	Tubes from a different charge or another manufacturer with different tube forming quality or different weld seam quality.	
Wrong weld seam position with permanently changing positioning	15	Drive without brake or with brake function switched off.	
Wrong weld seam position with constant offset	16	Check program parameter “Position Offset”	

If you are still unable to locate the reason of your problem and you need the support of the manufacturer, please send the filled-out checklist together with the information on the next page to Roland Electronic:

From the product label of the control please transfer these fields:

Type: _____ P.N. _____ S.N. _____

From the product label of the sensor:

Type: _____ P.N. _____ S.N. _____

The problem occurs with this tube / coil / drum:

diameter: _____ mm wall thickness: _____ mm material: _____

Company: _____

Address: _____

_____

Zip-code + City: _____

Your name: _____

Your telephone no: _____

Your e-mail: _____

Manufacturer of machine,
where SND40 is integrated: _____

Please add any comment that may help to identify the error: (e.g. since when does error occur, how often, under which situation, new tube / coil material, new tube sizes, new tube / coil supplier etc.)

_____

_____

_____

_____

---------- **End of Document** ----------