TECHNICAL MANUAL

Evaluation electronics: AMD 05

INDEX

Safety

Safety during transportation:

- If the prevailing permitted weight limits for movable goods to be transported by persons are exceeded, hoisting devices are to be employed!
- Assembling the hoisting device and the following transport may only be carried out by trained and authorized personnel!
- During transportation the prevailing safety regulations are to be observed!

Safety during operation:

- The electronics casing box has to be closed!
- People with implanted body aids may not stand in immediate proximity of the detector!
- Training of the personnel about audio-visual warning devices and rejection systems will be absolutely necessary!

Before carrying out repair or maintenance work at the device, note the following!

- Stop the conveyor belt!
- Disconnect from mains supply!
- Be careful of external voltages at the switch exits!

All components must be protected durably so that they may not be switched on!

Works at the device may only be carried out by trained and authorized personnel.

Operation of the device as provided

The device only serves for detecting metal in flight conveyors. The following products are excluded:

- **those contained in metallic or partially metallic casings,**

- **electrically conductive products**

- **products containing desired metal constituents.**

Since these products could possibly disturb the sensitivity of the metal detector, they may only be examined after consulting the manufacturer beforehand.

This device may not be operated

- **in areas with explosive hazards (customized version available),**

- **outside the stated protective system,**

- **outside the permitted temperature range.**

Operating the device in an improper way can lead to damages at the device and also to injuries or the death of persons.

Any structural change of the device may only be effected after consent and prior inspection of the manufacturer.

The data provided in the manual regarding operation, maintenance have to be observed. Works at the metal detector may only be carried out by trained and authorized personnel.

Access to Operating Level 3
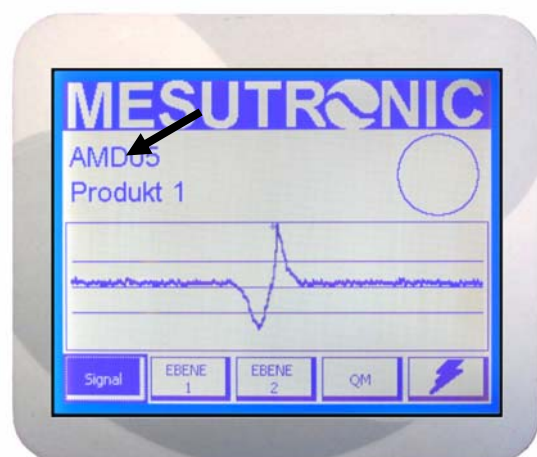
To gain access to operating level 3 during operation, you have to press, in the main operating mask

- the keys **„Up"** and **„OK"** simultaneously if using a **4 Line Display**.

- the **machine name** if you are using a **Touch Screen Display**.

You will then be asked to enter the access code for the Corresponding operating level. If you enter the access code for operating level 3, you will automatically go back to the main operating mask. Operating level 3 is now unlocked.

General

The metal detector is factory-preset. Normally there should be no or only minor changes required.

Note that adjusting the settings in an improper way can impair or prevent your metal detector from functioning.

On the following page, you will find an overview of all menu items. Depending on the application, some menu items may be de-activated and will therefore not be visible on the display. These menu items are marked as "(**optional**)".

⚠️ **Changes may only be carried out by trained and authorized personnel.**

Overview operating levels

Operating level 1

	see user manual chapter **Adjustment → Overview operating levels**

Operating level 2

	see user manual chapter **Adjustment → Overview operating levels**

Operating level 3

Basic sensitivity
Filter
    Noise filter
    Response filter
    Interf. signal time
    Eval. mode
    Eval. suppression
    Signal time

Switch outputs

    Relay 1

        After power on
        Normal state
        On metal
        On error

    Relay 2

        After power on
        Normal state
        On metal
        On error

    Active output 1

        After power on
        Normal state
        On metal
        On error

    Active output 2   (optional)

        After power on
        Normal state
        On metal
        On error

Operating block

    Selection

    Choose Operating block (all operating block)   (optional)

        Encoder

            Mode separate period
            Mode separate delay
            Prescaler encoder   (optional)
            Diameter   (optional)
            Pulses per revolut.   (optional)
            Speed   (optional)

        Separator

            Activating trigger
            Activation time
            Reset time trigger
            Reset time
            Cable rupture det.

        Pressure control

            Pressure control
            Edge pneum. switch
            Debounce time press

        Photo eye input

            Photo eye input
            Trigger input   (optional)
            Speed   (optional)
            Start of sensitive area   (optional)
            End of sensitive area   (optional)
            Trailing edge   (optional)
            Correct product length   (optional)
            Debounce time   (optional)
            Inverse detection   (optional)

        Pinch valve   *(optional)*

            Duration   (optional)
            Interval   (optional)

        Metal reset display

Level sensor

Level sensor	(optional)	
Edge level sensor	(optional)	
Deb. Time level sensor	(optional)	

Transm. level
Device name
Reject parameter 2
Reset mode
Speedsense   (optional)
    Speedsense   (optional)
    Ejection threshold   (optional)
Counter
    Metal counter
    Thereof large parts   (optional)
    Spark counter   (optional)
    Run. time meter
Measured values
Save factory settings
Compensationstable   **only at Touch Screen Display**
Characteristic   **only at Touch Screen Display**
Oszilloskop   **only at Touch Screen Display**
Materialparameters
    Material 1
        Name
        Angle Min
        Angle Max
    Material 2
        …
Serial interface
    Print service
    Card reader
    3964R-SPS
    Baud rate UART0
    Parity UART0
    Baud rate UART1
    Parity UART1

Operating level 3

Base sensitivity

In this mask, the value for base sensitivity amplitude and phase can be selected for two-channel evaluation. The amplitude and phase can be set to a value between „1" and „16".

> „1":   minimum sensitivity
> „16":   maximum sensitivity

The software sets the value of base sensitivity to the optimal value for the product to be learned during automatic learning. Since the learning process would become unncessarily slow for some products, if the learning process were always started at the maximum base sensitivity, the user can manually change/shorten the learning procedure by changing these settings. The value in this mask, set by the user, is taken as the starting value for the base sensitivity amplitude/phase for the automatic learning procedure.

If you have already set the sensitivity settings of your metal detector at a very low level, and your product nevertheless continuous giving error messages, you can decrease the base sensitivity of your metal detector.

see User Manual chapter **Adjustment → Operating Level 1→ Sensitivity**

Filter

In this menu, you can change the settings concerning the analysis of the measurement signal.

Noise filter

By means of a noise filter external high-frequency influences on the measuring signal can be eliminated. The value depends on the conveying speed. Please set the conveying speed.

Please note:

If the noise filter value is set lower than actual speed, loss of sensitivity will occur. The noise filter value should – if you can't be sure of the exact speed of your conveyor mechanism – be set higher than actual speed; under no circumstances should it be set lower.

Response filter

With the **Response filter** you can check the temporal behaviour of the measuring signal.

As described in the chapter "Principle of working", the measuring signal has to exceed both threshold-values in order to detect metal. To control the time the following fact is taken into consideration. If a metal part is conveyed through the detector, the measuring signal moves over both threshold values. Depending on the conveying speed the signal exceeds both thresholds for a certain amount of time. This length of time is a control criteria and shows that the metal detection has been correctly executed. The adjusted value, as described in the chapter **„Response filter",** represents the minimum length of time required above both thresholds. The response filter is set too high if the test piece clearly passes the threshold and there is no metal signal.

The manufacturer setting should only be changed if it is not possible to operate the metal detector fault free because of external influences. Response filter can be set to any value between 0 s (OFF) and 1 s.

see User Manual chapter **Introduction → Operating Principle**

Interfering signal time

The interfering signal time is the maximum admissible timeframe of the metal signal between the first and the second semi-cycle during the passage of a metal part through the detector coil. If the interfering signal time is exceeded, this generally means that the electronics are disrupted by external influences. Interfering Signal Time can be set to any value between 0 s (OFF) and 30 s.

Eval. mode

Usually, the metal detector is operated in the „two semi-cycle" evaluation mode, because metals always cause one positive and one negative measurement signal peak. In certain circumstances, the machine can operate in a „one semi-cycle" evaluation mode, for example if the second semi-cycle is reduced by the product's influence to such an extent, that the semi-cycle no longer exceeds the trigger threshold.

Eval. suppression

Eval. Suppression describes the time frames following an automatic reset, in which there is no metal detection. If metal detection were to continue immediately after a reset, vibrations caused by large metal parts falling through the separator or the separator itself could trigger false metal events. Eval. Suppression can be set to any value between 0 s (OFF) and 10 s.

Signal time

In order to avoid double releases by **a metallic part** you can adjust here the time within which only one release / notification is generated in case of a metal detection. The signal time can be adjusted between 0 s (OFF) and 2 s.

Switch outputs

Under the menu item „switch outputs" you can configure the switching properties of the following outputs:

- Relay 1
- Relay 2
- Active output 1
- Active output 2 (optional)

The outputs can be configured for 4 different states of the metal detector:

- **After power on:**

State of the output / relay during the adjustment process after switching on the device.

- **Normal state:**

State of the output / relay during normal operation of the metal detection device.

- **On metal:**

State of the output / relay when detecting metal.

- **On warnings:**

State of the output / relay when warnings.

- **On error:**

State of the output / when an error occured.

Switch conditions:

	OFF	**ON**	**HOLD**
Relay 1	Contacts 11 and 12 closed	Contacts 11 and 14 closed	The current switching state is held
Relay 2	Contacts 21 and 22 closed	Contacts 21 and 24 closed	
Active output 1	No voltage on output	Voltage on output	
Active output 2	No voltage on output	Voltage on output	

Factory settings:

	After power on	**Normal state**	**On metal**	**On warnings**	**On error**
Relay 1	OFF	OFF	ON	HOLD	HOLD
Relay 2	OFF	ON	HOLD	OFF	OFF
Active output 1	OFF	OFF	ON	HOLD	HOLD
Active output 2	OFF	ON	HOLD	OFF	OFF

Operating block

Choose operating block

With the menu item **choose operating block** you can change the terminal block of the application. You can select one of the available function blocks.

> see User Manual Chapter **Technology → Plug configuration → Terminal block**

Setting

Depending on which Operating block has been selected under **"Operating level 3 → Operating block → Choose Operating block"**, you can change the various settings for the relevant Operating block under menu item **Choose Operating block.** Depending on which Operating block has been selected, the following submenu items appear:

Encoder

Menu item	Description	Setting options
Mode separ. delay	This item sets whether the ejection delay should be given by a timer (TIME) or a rotating feeder (CYCLE).	TIME / CYCLE
Mode separ. period	This item sets whether the ejection duration should be given by a timer (TIME) or a rotating feeder (CYCLE).	TIME / CYCLE
Prescaler encoder	For rotating feeders with a very high impulse sequence per second, it is necessary to activate a prescaler encoder. The encoder should be activated at more than approximately 1000 impulses per second, otherwise the software might have difficulties processing the rotating feeder signal. The value may be entered as a ratio (1:1 to 100:1). 2:1 means that only every second external impulse is transmitted to the internal software.	1:1 – 100:1
Diameter (optional)	Enter here the diameter of the roll (plus the double belt thickness) on which the rotary encoder is operated. Only in mode release delay: CYCLE	5 mm – 999 mm
Pulses per revolut. (optional)	Enter here the cycles per rotation of the rotary encoder. Only in mode release delay: CYCLE	0 – 999 cycles
Speed (optional)	In dependency of the roll diameter and cycles per rotation the speed is indicated here [mm/cycle]	none

Separator

With the help of the **separating control** the evaluation electronics can control the current flap position of your switching filter. Using two **initiators, sensors or callipers** enables you to control the standard and the separating position.

During a separation process the system controls whether the separating flap leaves the standard position, reaches the separating position within the **activation time** and at the end of the separating time restores ist initial position within the **reset time**. If one of the durations defined above is exceeded, an error message is shown

The following values can be selected in the menu item **Separator**, depending on the selected terminal block:
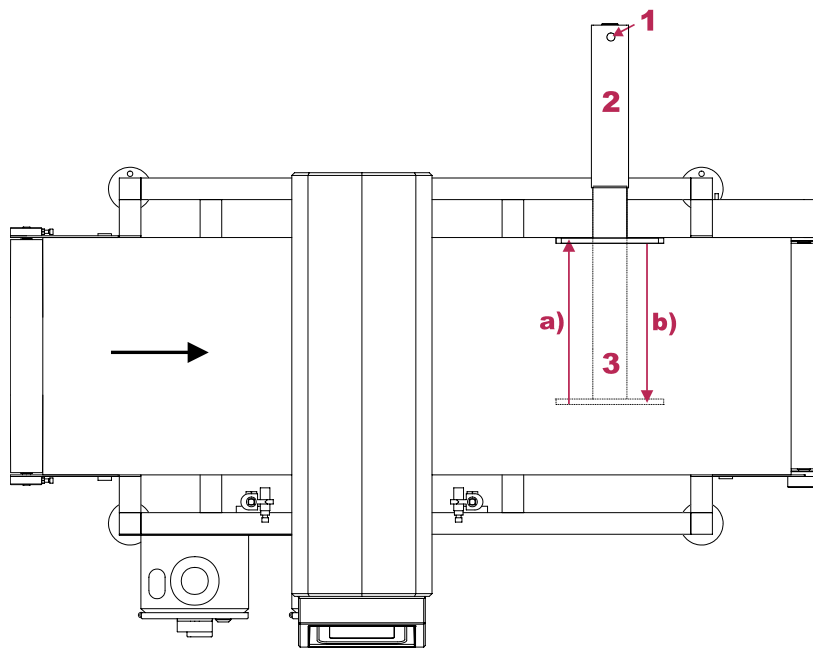
Adjustments on the example of a pusher:

1. Sensor
2. Standard position
3. Separating position
a) Reset time
b) Activation time

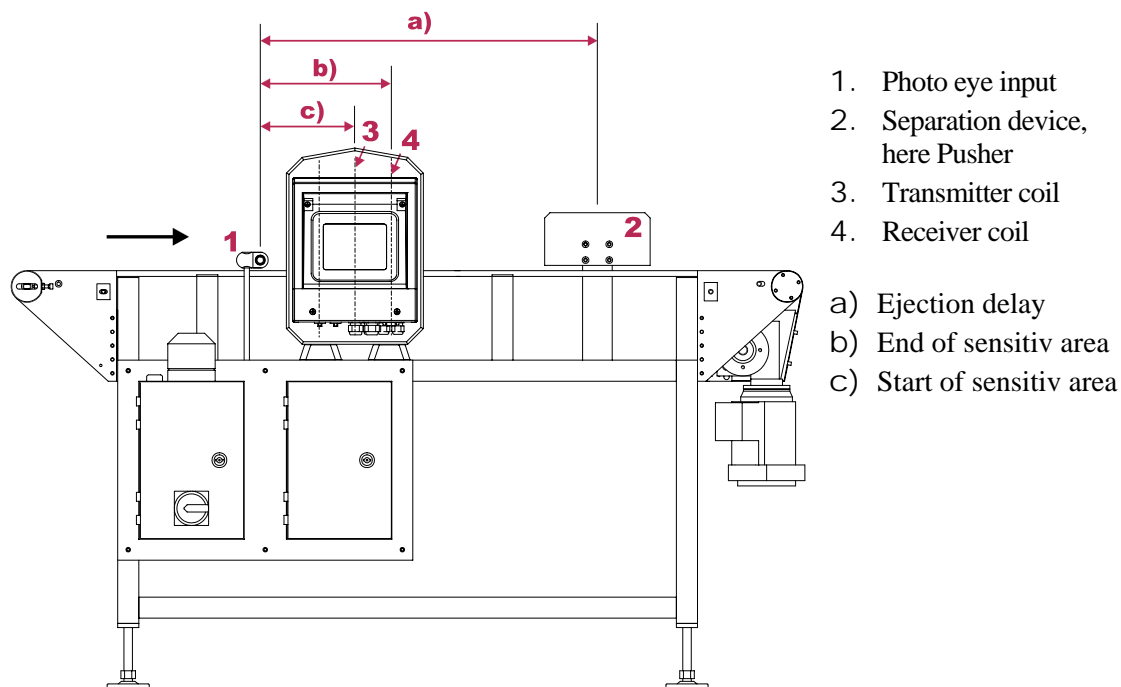| Menu item	Description	Setting options
Activating trigger	Flank at the initiator / switch in separating position, during change from standard position to separating position. (POSITIVE ≡ rising trigger / NEGATIVE ≡ falling trigger)	POSITIVE / NEGATIVE
Activation time	Duration, within which the separation flap has to reach the separating position. Activation time = 0 (OFF) → Control deactivated.	0 - 2000 ms (0 ≡ OFF)
Reset time trigger	Flank at the initiator / switch in standard position during change from separating position to standard position. (POSITIVE ≡ rising trigger / NEGATIVE ≡ falling trigger)	POSITIVE / NEGATIVE
Reset time	Duration, within which the separation flap has to reach standard position after separation. Activation time = 0 (OFF) → Control deactivated	0 - 2000 ms (0 ≡ OFF)
Cable rupture det.	Activating the cable break control. When cable rupture detection is active, the connector of active outlet 1 is monitored for interruptions. **Condition:** active outlet 1 "ON" must be set to metal.	ON / OFF

Pressure control

Additionally to the reject control system you can connect a **pressure control device**. The pressure control device should control whether the pressure of the pressurized air supply is high enough to operate the separation device.

Minor, temporary pressure variations (< **Debounce time press**), that do not impair the switching cess are ignored by the evaluation electronics.

The following values can be selected in the menu item Pressure control, depending on the selected terminal block:

Menu item	Description	Setting options
Pressure control	Pressure control activation	ON / OFF
Edge pneum. switch	Activation flank of the pressure switch from „pressure too low"-position to position" pressure OK". (POSITIVE ≡ rising flank/ NEGATIVE ≡ falling flank)	POSITIVE / NEGATIVE
Debounce time press	In order to prevent temporary variations in the pressurized air supply to cause error messages, you can determine a time-span under the menu item antibeat time within which the evaluation electronics suppresses the error message. If after the antibeat time is exceeded, the pressure should not be sufficient, an error message is shown. The error message vanishes as soon as the pressure is sufficient.	0 - 5000 ms

Photo eye input

1. Photo eye input
2. Separation device, here Pusher
3. Transmitter coil
4. Receiver coil

a) Ejection delay
b) End of sensitiv area
c) Start of sensitiv area

| Menu item	Description	Setting options
Photo eye input	For packaged products, an input light barrier is necessary to set the response delay such that the ejection mechanism is triggered precisely at the product start or product end. Furthermore, the input light barrier can be used to activate the metal detector when products are being conveyed.	ON / OFF
Trigger input (optional)	This setting allows the user to define the type of light barrier. high-aktiv > POSITIVE, low-aktiv > NEGATIVE	POSITIVE / NEGATIVE
Speed (optional)	**In cyclic operation:** As it can be difficult especially when using rotary encoders to adjust the delay period, the possibility was realised in the menu item rotary encoder to indicate the release delay in [mm] after the determination of the conveyor speed. The factor required for the conversion is calculated by entering the diameter of the drive roll (with belt thickness) and by entering the cycles per rotation of the drive roll. Input is carried out in the menu for rotary encoders. see the chapter **Adjustments → Operating level 3 → Operating block → Encoder** The speed is drawn on when adjusting the release delay and the delay periods light barrier Begin/End metallic sensitive area for the conversion between time/cycle specifications in length specifications. **In time operation:** For conveyors with constant speed the factor required for the conversion (conveyer speed) is simply entered.	In time operation: 0 – 99.9999 m/s In cyclic operation: none
Start of sensitiv area (optional)	Since metal event triggering in the detector only happens in the metal-sensitive area, this setting can communicate to the software the start of the metal-sensitive area (two semi-cycle evaluations just before the transmitter coil, measured from the intake light barrier). If the product speed has already been measured, the input is made in units of length, otherwise as time or cycle value. see **Drawing → c**	0 (OFF) – 30000
End of sensitiv area (optional)	Since the metal triggering inside the detector only happens in the metal-sensitive area, you can specify the end of the metal-sensitive area (at two-semi-cycle analysis, this is just behind the second receiver coil, measured from the intake light barrier) with this software value. If the product speed has already been specified, the input is given as a length measurement, otherwise as a time or cycle value. see **Drawing → b**	0 (OFF) – 30000

Menüpunkt	Beschreibung	Einstellmöglichkeiten
Trailing edge (optional)	Normally, the ejection delay is started when the product's front edge triggers the intake light barrier. If products of varying product length are conveyed (e.g. tree trunks), and the ejection mechanism is relatively close to the detector, it may be advisable to start the ejection delay with the rear edge (product end).	ON / OFF
Correct product length (optional)	With some conveyor belt applications (e.g. in the wood-processing industry), where various different product lengths are used, the **Correct product length** function ascertains that the product is always ejected in the middle. The ejection delay must then be set to the delay/distance between the entry-point light sensor and the ejection mechanism.	ON / OFF
Debounce time (optional)	Normally the release delay is started when the product triggers the intake light barrier. You can determine by adjusting the debounce time a time period within which the evaluation electronics oppresses the triggering. If after the expiry of the debounce time no product is detected the release delay does not start.	0 – 100 ms (0 = OFF)
Invers detection (optional)	If inverse detection has been activated (ON), all products, in which no metal has been found, are ejected (only possible with intake light barrier).	ON / OFF

Pinch valve (optional)

In this mask a milk device can be activated (ON) or deactivated (OFF) respectively.

Duration (optional)

The menu item **duration** is only available for machines with a dual sluice mechanism.
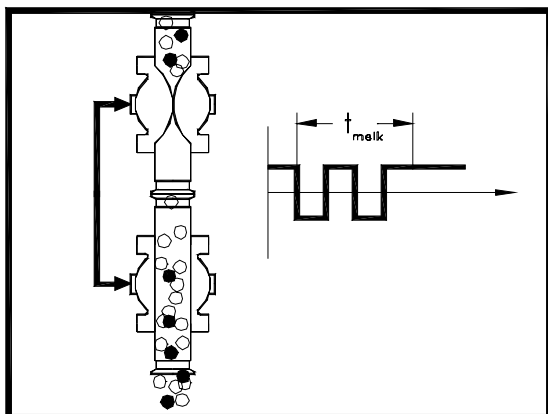
Duration sets the ejection duration of the dual sluice mechanism after a metal event.

The operation time of the double chamber sluice gate, emptying the rejection container after metal detection is pre-adjusted by the manufacturer. If needed, this "milk-time" can be adjusted via a potentiometer.

Interval (optional)

The menu item **interval** is only available for machines with dual sluice mechanism.

Interval changes the speed of the dual sluice, as needed.

Metal reset display

Under the menu item **Metal reset display**, you can select the following values, depending on the selected terminal block:

Menu item	Description	Setting options
Metal reset display	Activates / deactivates display reset after a metal event.	ON / OFF

Level sensor

Menu item	Description	Setting options
Level sensor	Activation of the level sensor	ON / OFF
Edge level sensor	Over this input value the type of the fill level sensor can be determined. high-active > POSITIVE, low-active > NEGATIVE	POSITIVE / NEGATIVE
Deb. time level sensor	The falling product causes an impulse on the fill level sensor. The impulse must be essentially shorter than the here adjusted value.	0 - 10000 ms (0 = OFF)

Transm. level

For products exhibiting a very strong product effect, the transmittor level can be reduced, should the automatic learning procedure not lead to correct results. You can set the transmitter level to values between 30% and 100%.

Device name

Under the menu item „device name" you can give the metal detection device a ten-digit name in order to prevent the danger of confusion when operating several devices. Possible symbols are the complete alphabet (small and capital letters) and all numbers.

Reject parameter 2

With this setting, the ejection delay and ejection duration can be activated (ON) for active outlet 2 and relay 2 (must be set to metal), independently from active outlet 1 and relay 1. The setting manipulation is done in **Operating Level 2 → Ejection Parameters.**

Reset mode

Depending on you application, you can reset a metal detection either **automatically** or **manually.** If no particular requests have been given by the customer, the metal detectors will be supplied with reset mode „**automatic**".

- **Reset mode automatic:**

Time-controlled metal notification is set for automatic ejection of metal-contaminated products. You may set the delay and duration of the metal notification in the menu "**Operating level 2 → Reject parameter**"

- **Reset mode manual:**

With this reset mode, you can only delay the metal signal, e.g. to remove the metal part from the opening. The machine is restarted by resetting the metal detector at the display or with an external reset button.

Speedsense

Under menu item **SpeedSense**, you can define a **rejection threshold.** Metal signals that exceed the ejection threshold are then ejected with the maximum ejection duration. These metal parts are stored separately in the metal counter under the heading "of which large parts". All metal signals that remain below the ejection threshold are ejected according to velocity.

Menu items	Description	Range
SpeedSense	Activation of SpeedSense	ON / OFF
Ejection threshold	see above	Ejection threshold [Voltage]

see chapter **Adjustment→Operating level 2 → Separating parameter → Reject time min / max**

Counter

Metal counter

The menu item metal counter on operating level 3 will show you the total number of all metal messages shown since activation of your device.

Spark counter (optional)

Run. time meter

This item displays the total operating hours of the machine.

Measured values

The menu item „Measure values" provides you with a possibility to read internal parameters of the metal detection electronics. These values are needed for service and diagnostic purposes.

Measurement designation	Measured values	
RX voltage	0.00V	Receiver voltage
RX check	0.25V	Receiver monitoring
TX voltage	11.2	Transmitter voltage
TX power	0.6V	Transmitter power
signal	0.00/0.00	Signal peak 1.HW/2.HW
tresh.	0.210V	Triggering threshold
noise	24mV	Interference level setting
angle	90.00	Compensation/learning angle
AMP signal	0.00V	Amplitude measurement value
AMP gain	2.50V	Amplitude measurement value enh. range
AMP low	2.50V	Interference level setting
PHA signal	0.00V	Phase measurement value
PHA gain	2.50V	Phase measurement value enh. range
PHA low	2.50V	Interference level setting
angle HW1	0.00°	Angle value 1st semi-cycle
angle HW2	180.00°	Angle value 2nd semi-cycle
+24VDA	24.00V	Power supply ext. connection

Save factory settings

Set **Save factory settings** to "ON", if you wish to save the settings in operating level 3 as factory settings.

Note:

If you adjust settings on operating levels 1 to 3 and save them afterwards as factory settings, you cannot load the preselected factory settings that are active at the time of delivery.

see too User Manual chapter **Adjustment → Operating level 2 → Restore factory setting**

Compensationstable (only at Touch Screen Display)

Dialogue for displaying the compensation chart. Only provided for service purposes.

Characteristic (only at Touch Screen Display)

The function „characteristics" enables a specific detection of metal types and thus also a sensitivity adjustment depending on the type of material. This guarantees considerably better sensitivity results than before, especially with ALUTRON applications(extraction of metal foils) and allows the use of all-metal detectors in these areas. Other applications can compensate for the differences in sensitivity resulting from physical conditions and the type of metal or change according to the project. The measurement results appear in uncoded text in the printer's record.

Oscilloscope (only at Touch Screen Display)

Only provided for service purposes.

Materialparameters

This function makes it possible to distinguish different metallic pollutions according to the kind of the metal.

5 different material parameters can be adjusted with name, angle_min and angle_max. If a material name is entered and is the currently calculated angle between the angle_min and angle_max values then the entered name is additionally output in the print protocol.

Serial interface

OFF: deactivated
UART0:   First optional serial RS 232 interface on the base blank Display
UART1:   Second optional serial RS 232 interface on the base blank Display

see user chaper **Technology** ➔**Key plan**

Menu item	Description	Setting options
Print service	With „**UART0, UART1**" you can activate the print service and deactivate with „**OFF**".	OFF, UART0, UART1
Card reader	Here you can activate or deactivate the optional card reader.	OFF, UART0, UART1
3964R - SPS	Over this menu item the communication can be activated via the 3964R protocol.	OFF, UART0, UART1
Baud rate UART0	Here you can select the baud rate for the communication between electronics and end device e.g. printer.	4800, 9600, 19200, 38400
Parity UART0	Choose here the same value as the communication partner (end device).	None, Even, Odd
Baud rate UART1	Here you can select the baud rate for the communication between the electronics and the end device e.g. printer.	4800, 9600, 19200, 38400
Parity UART1	Choose here the same value as the communication partner (end device).	None, Even, Odd

Set-up of RS 232 interface for printers (standard):

Baud rate:	9600
Parity:	none
Data bits:	8
Stop bits:	1
Data-flow control (Handshake):	none

Appendix

📂 **0**

Access codes

**Please keep this number in a safe place and
do not give it to unauthorized persons!**

Operating level 1:	**2484**
Operating level 2:	**2314**
Operating level 3:	**1072**
Operating level QM:	**2077**