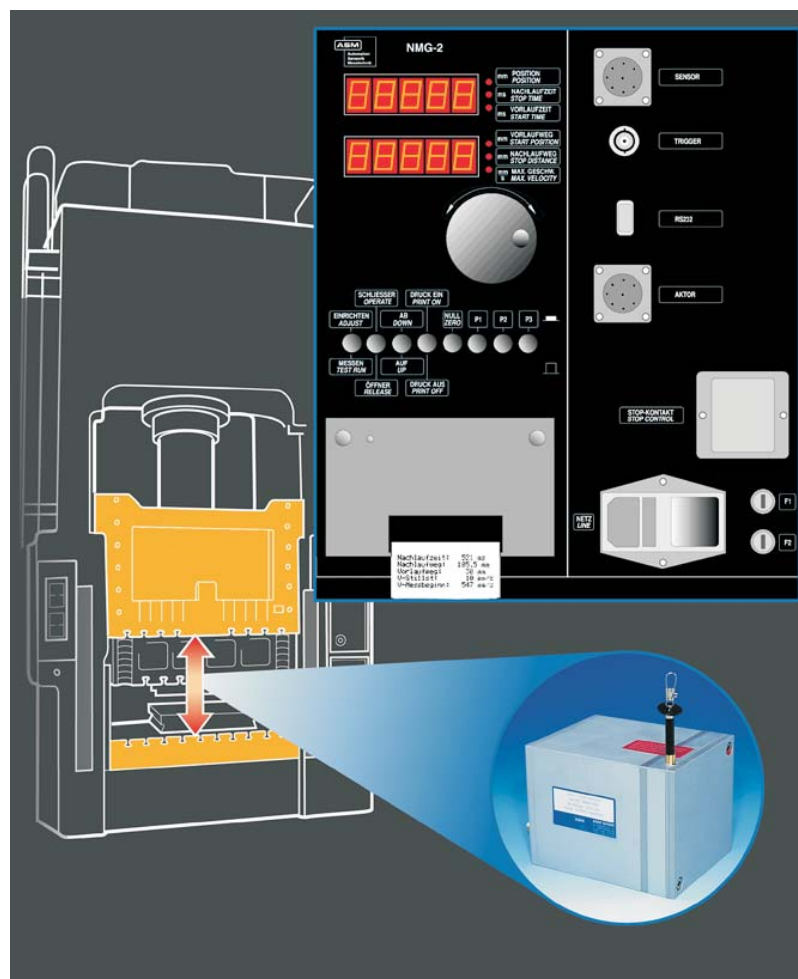


Stop-Time Measuring System NMG2

Operation Manual



Please read carefully before operation

The Instruction Manual for WS Sensors must be considered!



The device must be used according to the intended purpose only, since otherwise the protection of the device is not ensured.

Use the stop-time measuring system only in such a way that in the case of malfunction or failure no person can be injured and no machine can be damaged.

Do not override the safety devices of the machine.

Guarantee that the earthing contact of the line socket is on earth potential.

Do not attach the stop cable under voltage.

Do not open the WS sensor: Release of spring under tension can result in injury.

Do not let snap back the cable: Uncontrolled cable retraction of cable and clip can result in injury, sensor will be damaged.

Do not travel over range: Uncontrolled cable retraction can result in injury, sensor will be damaged.



Danger! The documentation must be considered.

Supplied Parts

1	Stop-Time Measuring System NMG2-2500-X im Koffer
1	Position Sensor WS2.1-2500-10-PP530-NMG
1	Sensor Connector Cable WS-KABEL-3M-NMG
1	Mains Cable NMG2-KG-SCHUKO
1	Stop Cable NMG2-STOPKABEL
1	Magnetic Clamp MAG1
1	Operation Manual NMG2, 1 Operation Manual WS Sensors
2	Keys
2	Spare Fuses: 1 AT, 5 AT

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**Special
Characteristics**

- Easy to use
- Portable and solid equipment
- Built-in matrix printer (option)
- Built-in RS-232 interface
- Fast set-up time
- Traceability of measurement values
- ISO9000 Calibration certificate
- Free adjustable stop point
- Standstill detection down to $v < 1$ mm/s
- Measurement of max. velocity
- Measurement of velocity at stop point

Options	Matrix printer NMG2-2500-P
	Measurement ranges from 1250 up to 30000 mm
	Actuator to release no-touch safety equipment
	RS-232 cable / PC Software
	Adjustable standstill detection

Operation Notes

In order to obtain optimum results of measurement with max. security and an effective use of the stop-time measuring system NMG2, please consider the following points:

Check after unpacking

Check the device after supply for transport damages. Particularly check the switches, control panels and sockets. If the stop-time measuring system is damaged or if deviations from the specifications in this operation manual can be recognized, contact us immediately.

Check before the first operation

Make sure that supply voltage indicated on the device corresponds with the supply network. Check likewise the assigned fuse . Replace the fuse only with the in the operation manual indicated type.

Grounding link

Guarantee that the earthing contact of the plug socket is on earth potential.

Maintenance

Opening the device means the loss of the warranty claim. The device may be opened by the manufacturer only. Periodical maintenance is not necessary.

Calibration

The stop-time measuring instrument was calibrated in the factory. It should be re-calibrated at least once per year. A traceable certificate can be provided.



Transport

The stop-time measuring system (425 x 325 x 205 mm) is suitable as hand baggage for the air transport. During transport the sensor must be inserted at the intended position. Disconnect the cable from sensor. Any Shipment only in sufficiently upholsterd packing.

Transportation case

The cover of the case may be opened to a maximum angle of 90°. The cover can be removed in the 45° position.

Safety Distance

The minimum safety distance for 2-hand guards or safety light curtains is calculated as a product of the machine stop-time and a determined maximum hand speed. The actual valid safety regulations (for example EN999) have to be regarded. The stop-time measurement must be made at the worst conditions of the machine to determine the maximum stop-time and the correct safety distance. Calculation and printout of the safety distance see chapter *Calculation of the Safety Distance*.

Description

The NMG2 is designed to measure stop time, stop distance and velocity of power driven machinery like presses, shears, welders, riveters and robots. In accordance with national and international safety standards machines with dangerous movements have to be equipped with protection devices. The improper placement of a protection device (2-hand control, safety light curtain and so on) will result in the potential for injury of the operator. With the NMG2 all the important measurement values such as stop-time, stop-distance and velocity are provided to calculate the minimum safety distance. The safety distance is defined in national and international standards like DIN EN999 / EN574. To ensure maximum safety the stop-time measurements have to be repeated periodically (6 months).

The measuring cable of the WS Position Sensor will be connected to the moving part of the machine with the magnetic clamp or a fixing screw. The Sensor sends an incremental pulse signal to the microprocessor controlled counter. The stop position can be selected by a digital encoder. The operator will adjust the stop position of the measurement to the position of max. velocity of the moving part of the machine.

To determine this max. velocity NMG2 provides the following measurement functions:

- Measurement of the max. velocity within the complete movement
- Measurement of the velocity at the stop position
- Measurement of the position of the max. velocity

If the position signal passes through the determined stop position in the selected direction a galvanic isolated contact will cause the stop of the machine and the stop-time measurement will be started. The position measurement values will be recorded until the machine has stopped completely. The two displays of the measuring device will show the measurement values of stop-time and distance. By pressing a button the velocity at the stop position can be displayed. A measurement protocol will be printed. The NMG2 electronics ensures that the measurement is started only at the adjusted stop position and only in the selected direction of motion.

The NMG2 can be used as a comfortable position and velocity measurement system in different applications. The measurement values can be transmitted to a PC or a Laptop via the RS-232 interface and processed with any software. Additionally an actuator can be controlled to interrupt a safety light curtain, so that it is not necessary to insert the relay contact into the machine circuit.

Specifications	Measurement Function Stop-Time	
	Measurement Range	0 ... 5000 ms
Resolution	1 ms	
Accuracy of Time Base	0.5 ms -0,05 %	
Stability of Time Base (Temperature)	±50 ppm / K	
Relay Compensation	Time delay of release contact will be compensated at every measurement	
Standstill Detection	$v < 1 \dots 10$ mm/s, default: 10 mm/s	
Measurement Function Position		
Measurement Range	-2500 ... +2500 mm (Standard) -9999 ... +9999 mm (Maximum) Measurement Range of Sensor up to 30000 mm	
Determination of Stop Point	-9999 ... 9999 mm	
Resolution of Measuring Device	1 mm (with Printer Option: 0.1 mm)	
Resolution of Sensor	25 µm	
Accuracy	±0.05 % Full Scale ±1 Digit	
Influence of Temperature	±0.005 % Full Scale / K	
Measurement Function Velocity		
Measurement Range	-9999 ... +9999 mm/s	
Resolution	2,5 mm/s	
Accuracy	±2,5 mm/s	
General		
Displays	2 x 4 Digit LED with Sign	
Trigger Output	Logic Signal 5 V, H → L at Stop-Point	
Stop Contact	NC / NO, 230 V AC / 5 A	
Fuse Protection of Stop Circuit	5 A slow-blow	
Supply Voltage	100 - 240 V AC	
Power Consumption	30 W max.	
Dimensions	425 x 325 x 205 mm	
Weight	10.5 kg incl. Case	
Operation Temperature	0 °C ... 40 °C	
Humidity	80 % R.H. max., non condensing	
Immunity to Interference (EMC)	According to IEC 1000-4-2, 3, 4	

**Identification of
Controls and
Displays**

[1] TEST RUN/ADJUST

This button offers a reset function in the ADJUST position. The values of stop time and stop distance will be set to zero and the stop contact is in normal position. The machine can be operated and no measurement will be performed. Measurement will be started in the TEST RUN position only.

[2] RELEASE/OPERATE

This button sets the function of the relay stop contact connected into the stop circuit of the machine (OPERATE or RELEASE). In most cases the RELEASE function is used. This button must be set before starting measurement!

[3] UP/DOWN

Toggles the measuring direction.

UP = pull out measuring cable = positive counting.

[4] PRINT ON/PRINT OFF

Switches the built in printer on or off.

[5] ZERO

Sets the measuring system to zero.

[6] Velocity measurement (V_{max})

In the VELOCITY MEASUREMENT mode the max. velocity and the corresponding position can be measured.

[7] The Actuator Option

An actuator to break safety light curtains is available as an option.

[8] Automatic Measurement Mode

In the automatic measuring mode it is possible to perform any number of measurements without pressing the key ADJUST/TEST RUN. After each measurement the stop contact is set to the normal condition automatically and the machine can be moved. If the machine passes the stop point in the opposite direction the measurement data will be deleted and the NMG2 is ready for the next test run.

[9] Jog wheel

With the jog wheel the stop position of the stop-time measurement can be set. Example: The moving part of the machine, e.g. a press, is in the top dead center and the wheel is turned until the stop-point display [18] shows -500. That means that the measurement will be started 500 mm below the top dead center of the machine. The result of the measurement will be shown as a negative value because of the downward movement.

[10] LED Indicators

Assignment of display and shown parameter.

[11] ... [16] Definition of the measurement displays.

[17], [18] Displays 4 digits + sign.

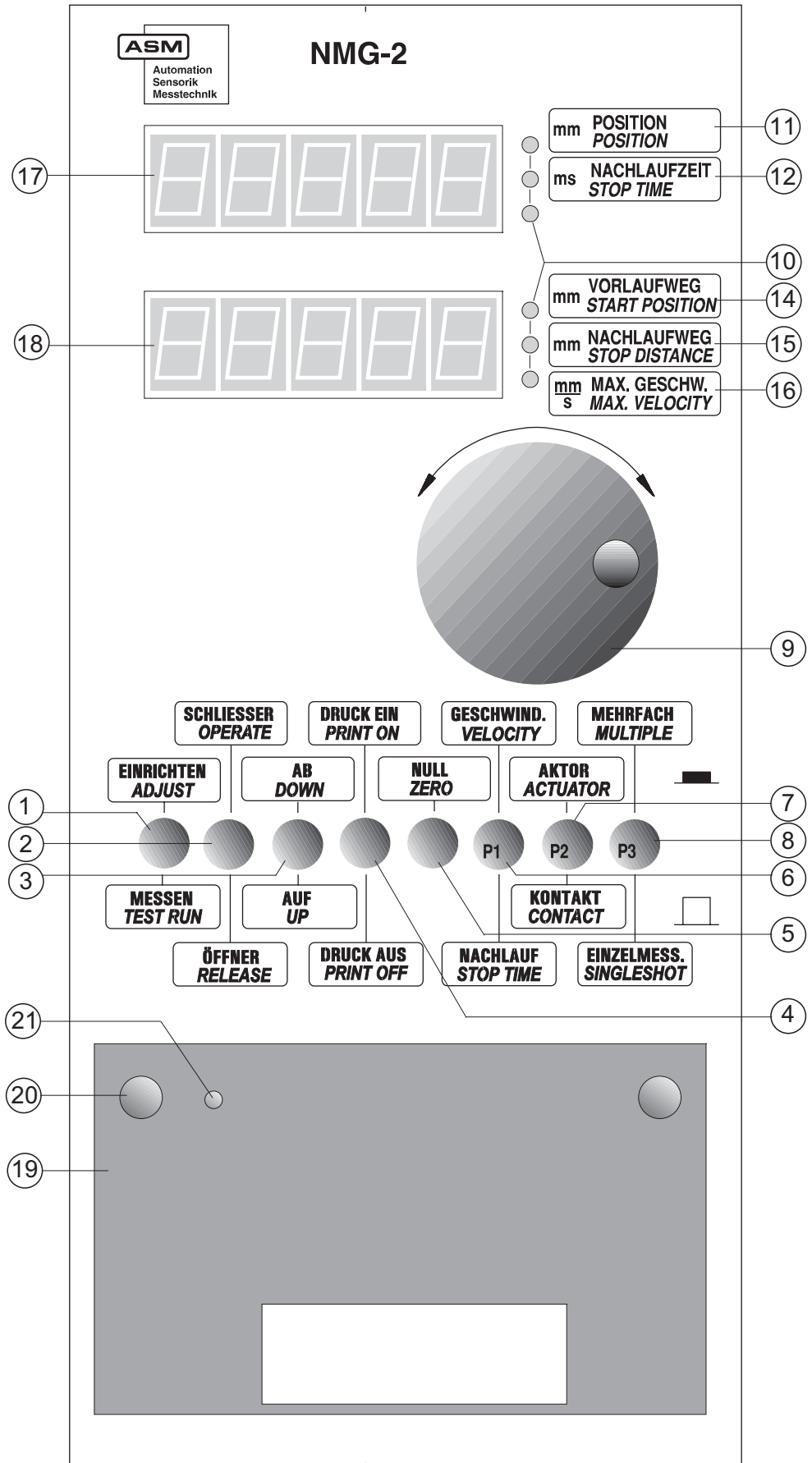
[19] ... [21] Protocol printer, see chapter *Protocol printer*.

NMG2

Stop-Time Measuring System



Controls and Displays



**Identification of
the connectors**

[22] Line Connector.

[23] Line fuse 500 mA slow blow.

[24] Line switch.

[25] Connector for stop cable to be connected into the safety stop circuit of the machine.

[26] Fuse F1 for the stop control circuit, **5 A slow blow.**

[27] Connector for the WS position sensor, 8-pin DIN socket.

[28] Trigger output

The signal changes its potential from logical 1 to logical 0 (+4,5 V to 0 V DC) if the stop control is released. The Signal can be used to trigger data recorders or other registration devices.

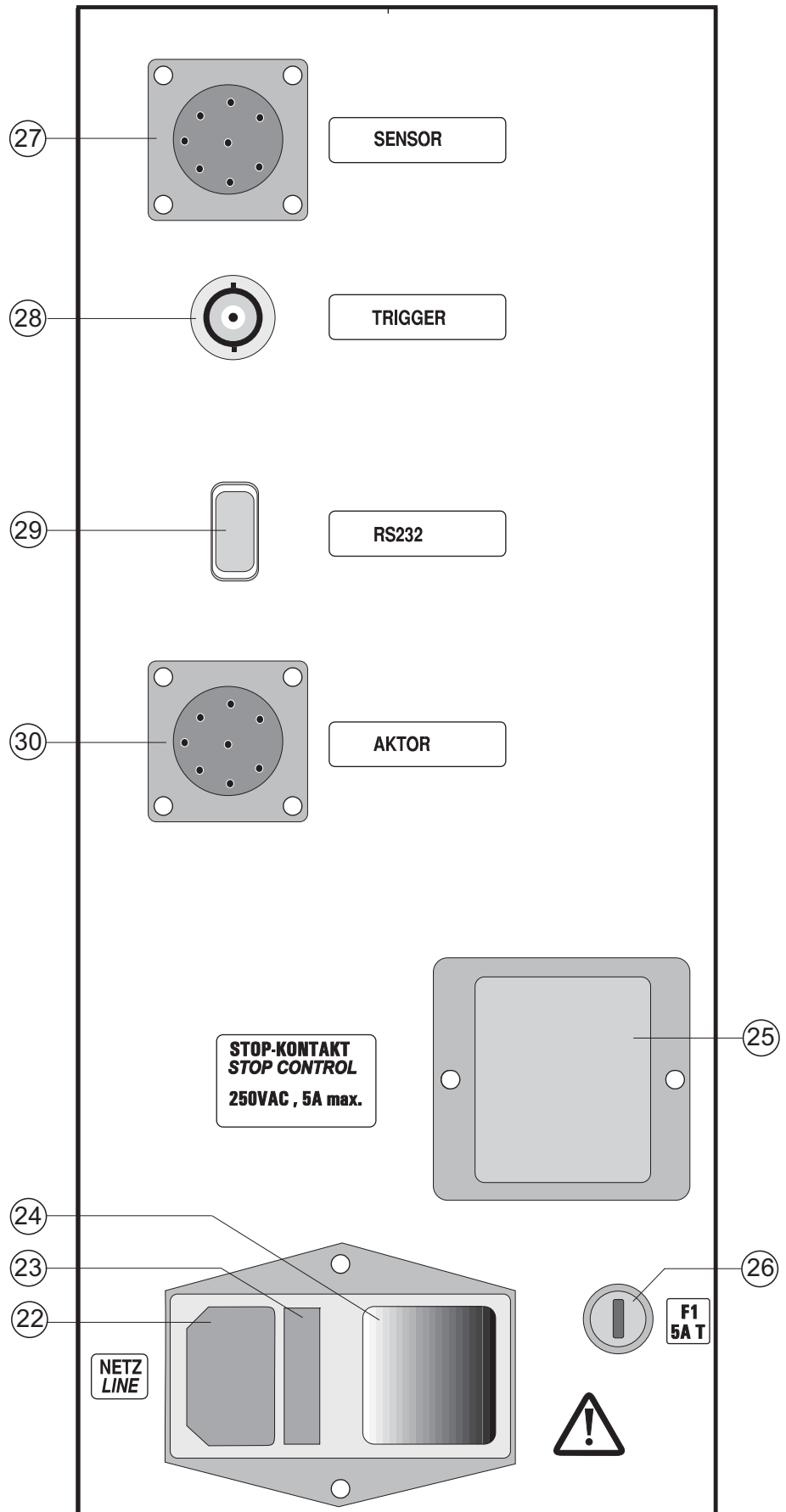
[29] PC connector RS-232

The measurement data can be transmitted to the PC in ASCII format and processed there.

[30] Actuator connector

The actuator causes the interruption of light curtains and light barriers.

Connectors



Installation and Operation



Operate the measuring instrument only in such a way that no danger for persons or machines can occur.

The measuring cable must not be oiled or lubricated. Do not break the cable!

Do not let snap the cable and do not travel overrange (see Instruction Manual for WS Position Sensors).

Operate the device only at plug sockets with protective ground.

Replace fuses only with the in the operation manual indicated type .

Do not override the safety devices of the machine.

In the ADJUST mode no stop signal will be released.

Preparation

1. Connect the Stop-Time Measuring System and the WS Sensor with the 8-wire sensor cable.

2. The connection of the cable clip to the moving part of the machine to be tested is made with the magnetic clamp or an eye. Do not let snap back the cable! Note that the applicable force on the magnet is reduced in the case of tangential force or on coated (paint) or uneven surfaces.

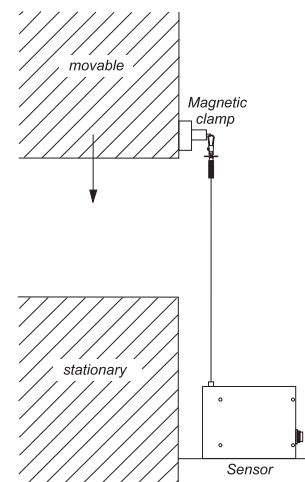
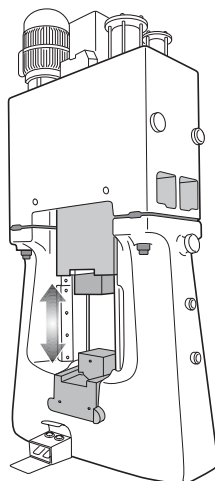
Mount the sensor on a plain base (s. figure below). Note that a cable misalignment will cause measurement errors!

3. Make sure that the machine is switched off and connect the stop cable (2-wire) into the safety circuit of the machine and connect the other end with the stop cable connector [25] of the NMG2.

4. Connect the power supply with the line socket and make sure that the earthing contact of the plug socket is on earth potential.

5. Switch on the machine.

5. Switch on the Stop-Time Measuring System.



Setup

Real-Time Clock The NMG2 has a real-time clock with backup battery. During each measuring process the current date and time are stored. On the printout and via the serial data communication date and time are displayed.

Setting of the Real-Time Clock

Switch off the NMG2 and set button [1] in the ADJUST position. Keep the ZERO button [5] pressed und switch on the NMG2.

Both displays show the message FUNC;END. Turn the jog wheel [9] clockwise until the display shows FUNC;ddtt.

Push briefly the ZERO button [5] to achieve the date/time setting mode:

1. d;31 ⇒ set the day (e.g. 31) with the jog wheel [9] and push briefly the ZERO button [5]
2. dd;7 ⇒ set the month (e.g. July=7) with the jog wheel and push briefly the ZERO button [5]
3. ddd;96 ⇒ set the year (e.g. 96) with the jog wheel and push briefly the ZERO button [5]
4. tt;16 ⇒ set the hour (e.g. 16) with the jog wheel and push briefly the ZERO button [5]
5. t;24 ⇒ set the minutes (e.g. 24) with the jog wheel and push briefly the ZERO button [5]

When the display shows FUNC;END then push the ZERO button [5] to return to the ADJUST mode.

Standstill Velocity

FUNC;END	⇒	Stop
Zero button	⇒	Adjust from 1 up to 10 (mm per second)
Default value:		10 mm/s

Printer/RS-232 language

1	⇒	German
2	⇒	English (mm)
3	⇒	English (mm & inches)

**Velocity
Measurement**

1. Select the correct relay contact mode with button [2]. Usually the safety circuit of the machine should be interrupted and button [2] should be set to RELEASE. You cannot move the machine if you have made the wrong selection. The buttons P1 to P3 ([6], [7], [8]) are not pressed.
2. Move the machine to the starting point.
3. Reset the system with the ZERO button [5]. The position value will be kept until the system is switched off or the sensor position will be changed.
4. The velocity will be captured in the measuring direction set with button [3]. Pulling out the measuring cable corresponds with the UP direction and will cause positive counting.
5. Adjust the start position (start of measurement) with the jog wheel [9] that the whole movement of the machine will be captured. The recommended value is +2 mm for upward movement and -2 mm for downward movement. The evaluation of the velocity will take place between the start position and the detected standstill.
6. Press button P1 [6] and then set button [1] to TEST RUN.
7. Start the machine. The machine will perform a complete cycle, the stop contact will not be released. After pressing the button ZERO [5] the max. velocity (display [18]) and the corresponding position (display [17]) will be shown.
8. Now the start position can be adjusted to the position of the max. velocity. Set the button [1] in the ADJUST position, release button P1 [6] and adjust the start position with the jog wheel [9]. Now a stop-time measurement can be performed (chapter *Stop-Time Measurement*, beginning from step 6).

**Stop-Time
Measurement**

1. Select the correct relay contact mode with button [2]. Usually the safety circuit of the machine must be interrupted and button [2] must be set to RELEASE. You cannot move the machine if you have made the wrong selection. The buttons P1 to P3 ([6], [7], [8]) are not pressed.
2. Move the machine to the starting point.
3. Reset the system with the ZERO button [5]. The position value will be kept until the system is switched off or the sensor position will be changed.
4. Select the measuring direction with button [3]. Pulling out the measuring cable corresponds with the UP direction and will cause positive counting.
5. Adjust the start position of the measurement with the jog wheel [9]. The start position [14] will be shown in the display [18]. The measurement should be started at the position of the max. velocity of the moving part of the machine (see chapter *Velocity Measurement*).

Stop-Time Measurement (cont'd)

6. Set button [1] to TEST RUN.
7. Now the first measurement can be performed: Start the machine. If the moving part of the machine passes the determined stop position the stop contact will cause the stop of the machine. The NMG2 will detect the complete standstill of the machine and will display the parameters Stop Time and Stop Distance. Press the P1 button [6] to display the velocity at the stop position, if necessary.
8. After evaluation and documentation of the measurement values set the button [1] to the ADJUST position and move the machine to the starting point again. Now a new measurement can be performed. To repeat measurements skip steps 1 to 5.

Example:

Stop-Time Measurement with a 2-hand controlled hydraulic press, stroke length 500 mm approx.

1. Button [2] in RELEASE position
2. Move press to the top dead center
3. Press button ZERO [5]
4. Button [3] in DOWN position
5. Adjust start position to -100 mm
6. Button [1] in TEST RUN position
7. Start the press with the 2-hand control. NMG2 will stop the press and will determine the measurement data
8. Documentation of the measurement values

Automatic Measurement Mode

The stop-time measurement as well as the velocity measurement provide an automatic measurement mode. Steps 1 to 5 are similar to chapter *Stop-Time Measurement* resp. *Velocity Measurement*. Continue as follows:

6. Press button P3 [8] and then set button [1] to TEST RUN.
7. Start the machine. When the moving part of the machine passes the start point the machine will be stopped. The stop time and the stop distance (max. velocity) will be displayed and printed tabulated. The stop contact will be re-set immediately and allows the machine movement again.
8. Move the machine back to the zero position. If the machine passes the stop point in the opposite direction the NMG2 will be prepared for a new measurement; the next measurement can be performed immediately.
9. By pressing the ADJUST button the operation will be stopped and the safety distance will be calculated. Also a number of measurements can be assigned (see chapter *Safety Distance*).

PrinterProtocol

As an option the NMG2 can be equipped with a protocol printer. With the button PRINT ON [4] the printer can be activated. After a test run the measurement data will be printed. It is possible to print the data after a measurement or the same printout again by pressing the button [4]. Setting button [1] to ADJUST clears all measurement data and a printer output is not possible any longer.

The button [21] causes the printer paper feed. During printing a paper feed is not possible. If the printer output is started, the printing cannot be aborted.

Protocol
Stop Distance
Measurement –
Single
Measurement

```

Stop-Time Protocol
NMG2, ASM GmbH
Date: 28.06.2000
Time: 07:44:10
--- Setup Values ---
Protocol Id: 00000001 →①
Start Pos.: 50 mm →①
V Standstill: 10 mm/s →②
Direction: outwards →③
Relay Contact: operate →④
----- Result -----
Stop-Time: 289 ms →⑤
StopDistance: 275.8 mm →⑥
V-Startpos.: 935 mm/s →⑦
-- Back Movement --
STT-Abs: 697 ms →⑧
StopPos-Abs: 3 mm →⑨
Back-Pos.: 3 mm →⑩
    
```

① Protocol ID (can be set by the customer, see page 23, chapter *Input of a protocol ID*)

① Adjusted measurement start position. At this point the contact will be released and the measurement will be started.

② A velocity value lower than indicated will be detected as standstill. This velocity can be programmed by the manufacturer between 1 ... 10 mm/s. Thus very slow machines can also be measured. Standard adjustment ex factory is 10 mm/s.

③ Adjusted measuring direction

④ Adjustment of relay contact

⑤ The measured stop time

⑥ The measured stop distance with a resolution of 0.1 mm

⑦ Velocity at start point

The following items will be printed only if the moving part of the machine performs a back movement without standstill

⑧ Time up to the final standstill

⑨ Position of the final standstill

⑩ Max. achieved position in back direction

```

Protocol                Stop-Time Protocol:
Stop Distance         NMG2, ASM GmbH
Measurement –         Date: 10.07.2002
Automatic            Time: 09:50:37
Measurement         --- Setup Values ---
                        Protocol Id: 02080343    →①
                        Start Pos.: 20 mm        →②
                        U Standstill: 10 mm/s     →③
                        Direction: outwards      →④
                        Relay Contact: release   →⑤
                        Gr = 2000 mm/s
                        F1 = 100 %              →⑥
                        F2 = 0 mm
                        t2 = 0 ms              →⑦
                        →⑧
Nr.      STT    STD    U-St
                ms    mm    mm/s
1             763    371    265
2             990    378    315
3            1242    550    280
-----
MAX          1242    550    280
MIN           763    371    265
--- Safety Distance ---
Safety Dist.: 2484 mm →⑨
Check for Minimum
Safety Distance !

```

- ① Protocol ID (can be input by the customer, see page 22, chapter *Input of a protocol ID*)
- ② Adjusted measurement start position. At this point the contact will be released and the measurement will be started.
- ③ At this velocity standstill will be detected. This velocity can be programmed by the manufacturer between 1 ... 10 mm/s. Thus very slow machines can also be measured. Standard adjustment ex factory is 10 mm/s.
- ④ Adjusted measuring direction
- ⑤ Position "RELEASE"
- ⑥ Parameters to calculate the safety distance (see page 22)
- ⑦ Stop time
- ⑧ Stop distance
- ⑨ Velocity at the start of measurement
- ⑩ Calculated safety distance

```

Protocol          Velocity Protocol
Stop Time        NMG2, ASM GmbH
Measurement -    Date: 28.06.2000
Single          Time: 07:47:30
Measurement      --- Setup Values ---
                Protocol Id: 00000001    →①
                Start Pos.:    50 mm      →①
                U Standstill:  10 mm/s    →②
                Direction:    inwards     →③
                ----- Result -----
                U-Max.:       -827 mm/s   →④
                Pos(U-Max):   50 mm       →⑤
                U-Start Pos.: -827 mm/s   →⑥
                Start Pos.:   50 mm       →⑦
    
```

- ① Protocol ID
- ① Adjusted measurement start position
- ② The velocity (independently of the sign), where standstill of the machine will be detected
- ③ Adjusted measuring direction
- ④ The max. velocity occurred after the start of measurement
- ⑤ The position where the highest velocity was achieved
- ⑥ The velocity at the start position
- ⑦ Adjusted start position

```

Protocol          Velocity Protocol:
Stop Time        NMG2, ASM GmbH
Measurement -    --- Setup Values ---
Automatic        Protocol Id: 00000001    →①
Measurement      Start Pos.:    50 mm      →①
                  U Standstill:  10 mm/s    →②
                  Direction:    outwards     →③
    
```

Nr.	Umax mm/s	PosU mm	Ubeg mm/s
1	1115	263	602
2	1720	242	785
3	1780	266	992

- ① Protocol ID
- ① Adjusted measurement start position
- ② The velocity (independently of the sign), where standstill of the machine will be detected
- ③ Adjusted measuring direction
- ④ Max. velocity
- ⑤ Position of the max. velocity
- ⑥ Velocity at the start point

Protocol Printer Ribbon and Paper Replacement

To change the paper roll or the ribbon cartridge the printer module must be removed. Make sure that the NMG2 is switched off.

1. Remove the front plate

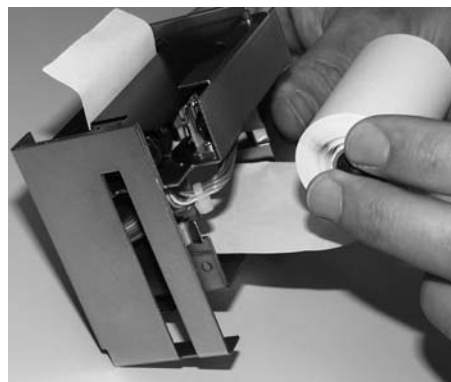
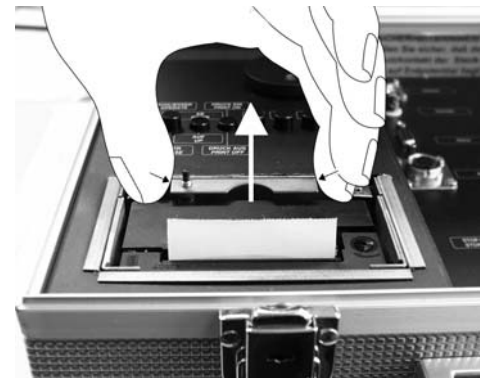
Detach the knurled screws [20] and remove the front plate [19].

2. Replacement of the ribbon cartridge

To change the ribbon cartridge push the edge of the old cartridge on the right hand side, there's written PUSH and EJECT. The cartridge will come loose at the right hand side and can be removed. Tighten the ribbon of the new cartridge by turning the small wheel on the right hand side of the cartridge in the direction of the arrow. Lead now the ribbon cartridge across the paper. The paper must be between the textile ribbon and the plastic bar. Be sure that the cartridge is engaged in the correct position.

3. Replacement of the paper roll

The housing is suitable for paper rolls of 38 mm diameter. Seize the bracket plate with the form feed key with thumb and index finger (see illustration). Pull the printer module completely upward from the housing. Remove the ribbon cartridge as described in step 2. Take the spindle with the core of the empty roll and set the spindle into the core of the new paper roll. Set the paper roll into the housing in such way that the paper unwinds downward in the back and let the strip of paper come out of the window to the front. If necessary cut off straight the end of the paper strip. The end of the paper must be inserted from the bottom into the designated slot at the printer unit until a noticeable resistance appears. Now turn the rubber roller in the center of the unit until the paper comes out of the printing mechanism approx. 5 cm. Install the ribbon cartridge as described in step 2. Now push the printer unit back into the housing.



Make sure that the surface is plain, so a correct electrical connection is achieved.

4. Assembly of the Front Plate

Insert the end of the paper roll from the rear through the slot of the front plate. Fasten the front plate with the knurled screws [20].

Printer	Printer paper, 1 roll	NMG2-DP
Material	Printer ribbon , 1 piece	NMG2-DF

Actuator Option

Description

The Actuator option will be used to release no-touch safety equipment (light curtains, light barriers and so on). In the actuator mode the actuator plate will be extended 10 mm into the active area of the safety equipment if the machine passes the start position. This will cause the stop of the machine. The measurement will be started. After standstill of the machine the measurement values will be printed.

Assembly

Fasten the actuator NMG2-AKTOR to the linkage of the magnetic clamp and connect it by means of WS-KABEL-3M-NMG to the socket AKTOR of the NMG2. Attach the magnetic clamp to a ferrousmagnetic machine part in such way that the actuator plate can move into the protection area. Push the button P2 [7] of the NMG2.

Test Run

The execution of the measurement takes place as shown in previous chapter (see page 13, *Stop-Time Measurement*). When passing the starting point the actuator will be released and the machine is forced to standstill. The result of the measurement is displayed and printed out if necessary.

RS-232 Interface

Description

The RS-232 option can be used to transmit the measurement data to the PC. After a measurement the measured data is sent to the interface without handshake. The data can be received by a terminal program, stored and then imported into a word processor or a spread-sheet software.

Commands:

1. By sending the letter "r" via the interface the measurement protocol will be transmitted when the measurement has been performed (button [1] in the TEST RUN position).
2. By sending the letter "a" via the interface the internal motion data will be transmitted after the measurement (button [1] in the TEST RUN position).

The NMG2 transmits the position data from the start of the measurement (start position) with a sample rate of 0,5 ms (separator is in each case a tabulator). The position axis is scaled in μm and the time axis in μs . This data format can be read and analysed by data evaluation programs such as Excel, Famos or the like. So the presentation and analysis of the position and velocity profiles of the machines is possible.

Connection

Connect the NMG2 with RS-232-extension cable (pin-to-pin connected) to the PC. This cable is available under the order code NMG2-RS232-KABEL and can be attached to both 9 pin and 25 pin interface sockets.

Transmission Parameters

Data transmission rate	9600 Bd
Data bits	8
Stop bits	1
Parity bit	no
Protocol	no handshake

Calculation of the Safety Distance and setting of the parameters

(presentable via printer or RS-232)

In the automatic measurement mode (MULTIPLE [8] pushed) the safety distance of the safety equipment (2-hand control, light curtain etc.) can be calculated. If the hand speed is not zero in the basic setting, the safety margin is calculated from the max. stop time. A number of measurements can be set.

The following formula is used:

$$s = gr \cdot (t1 \cdot F1 + t2) + F2 \quad \text{with}$$

s = Safety distance in mm

gr = Hand speed (adjustable in steps of 200 mm/s).

$t1$ = Measured stop time

$F1$ = Proportional addition factor for stop time (adjustable from 100 up to 200 %). Designated as [F1] in the basic setting

$F2$ = Addition to the safety distance (adjustable in steps of 10 mm)

$t2$ = Addition to the stop time (adjustable in steps of 10 ms)

Examples:

1. 2-hand control (see EN999, EN574)

$gr = 1600$ mm/s; $F1 = 100$ %; $F2 = 0$ mm; $t2 = 0$ ms

2. Light curtain (see EN999, EN574)

$gr = 2000$ mm/s; $F1 = 100$ %; $F2 = 0$ mm (depending upon size of the obstacle); $t2 = 20$ ms (resp. other reaction time of the BWS).

Basic Setting of the Formula Parameters

The button TEST RUN/ADJUST must be set to ADJUST. Press the ZERO button (and hold), set the button TEST RUN/ADJUST to TEST RUN and then release the ZERO button.

Both displays show FUNC;END. Turn the jog wheel clockwise until [gr] will appear]. Press the ZERO button to achieve the setting mode for the hand speed, which can be adjusted now with the jog wheel. Then press the ZERO button. Now FUNC;END appears again.

After selection with the jog wheel set the parameters F1, F2 und t2 in the same way.

In addition a number of measurements can be set (parameter n). For n=0 the automatic measurement mode will be terminated by pressing ADJUST. Press the button TEST RUN/ADJUST to leave the setting mode.

Example

Automatic Measurement with Safety Distance Calculation

Set the NMG2 in the automatic measurement mode (SINGLESHOT/MULTIPLE pressed, button TEST RUN/ADJUST released). The printout shows the header with the assigned formula parameters. Start the machine. The machine will be stopped and the stop contact will be released. Proceed to the assigned number n of measurements, then terminate the automatic measurement by setting the button TEST RUN/ADJUST to the ADJUST position. Minimum and maximum stop time will be determined and printed. The safety distance will be calculated by the max. stop time and the given formula parameters and then be printed.

**Input of a
Protocol ID**

In the ADJUST mode the user can input a freely selectable 8-digit protocol ID. This protocol ID appears in the printout and in the RS-232 transmission if not zero.

Procedure

Press the ZERO button in the ADJUST mode. At one display three LEDs light up. This display can be adjusted with the jog wheel [9]. Press ZERO again and hold it, now the second display can be adjusted.

The upper display [17] shows the first 4 characters and the lower display [18] the last 4 characters of the ID.

Now the protocol ID appears in the printout.

Error Numbers

If an operation or device error occurs the NMG2 will show an error number in the lower display [18].

The error number can be deleted by pressing the button ADJUST/TEST RUN [1] or switching off the device.

Meaning of the error numbers

Error number	Description
11	Line interruption: The NMG2 has detected a line interruption.
12	Printer error: The built-in printer doesn't respond.
51	Measurement aborted: After the start of the measurement the measurement has been aborted by the user.
52	Measuring time too long: No standstill within the max. measurable stop time (5 s).
53	Measurement velocity: The permissible measurement velocity was exceeded.
54	Measurement acceleration: The permissible measurement acceleration was exceeded.
91	RAM error: A defective memory cell has been found.
92	Relay operation: Relay not in the defined switching condition. Relay defective.
93	Relay time: The max. permissible relay switching time was exceeded. Relay defective.
94	Actuator not connected (actuator button pushed) Actuator defective
95	Actuator slow Switching time too long

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