MIDDEX
ELECTRONIC

WK1 Broken Tool Detector Installation Guide

Thank you for purchasing a Middex Broken Tool Detector. Our monitors are widely used in automated manufacturing industries on screw, drill, tapping, transfer, CNC and special purpose machines to check tools such as drills, taps, reamers, form tools etc. Unattended machining carries the risk of an unnoticed tool breakage, resulting in faulty parts and wipe-outs of tools further down the line. This adds sometimes a hefty tool replacement cost to the bad parts. Checking a tool physically after each use with a sensor probe is the most economical way to detect a broken tool. Each controller and sensor goes through a burn-in phase and thorough check before they are shipped from the factory. Please read the manual and avoid problems during installation. Refer to this manual if you encounter difficulties. Please call on us if you need help.

How does the WK1 work

Activating the "TEST" input starts the tool checking cycle, the probe sweeps towards the tool. If the monitored tool is in place the green LED "OK" comes on and a signal appears on terminal #10. With a broken tool the sensor will move beyond the tool position to its end stop and the red LED "NO OK" comes on with a signal appearing on terminal #11. A system fault will trigger a blinking yellow "FAULT" LED and a steady signal appearing on terminal #12 and on terminal #11. These output signals are available as long as the "TEST" input is active! These output signals are +24V and may be wired directly into a PLC. The "OK" signal is used in the logic that the machine controller is waiting for a tool "OK" before machining continues. The "NO OK" signal is used to interrupt an automatic cycle. Usually only one of the signals is used, mainly the "NO OK", because multiple "NO OK" signals may be combined into one input.

Sensor WKLR22 or WKLR32

The sensor is a miniature precision instrument containing a small DC motor with gearbox, circuit board, universal joint, and end stops. It is packed into a threaded housing and is sealed against dust and liquids. All moving parts are lubricated for the entire life of the sensor. WKLR22 (dia. 22mm) or WKLR32 (dia. 32mm) sensors are available with sweeping angles of 45°, 60°, 90°, 120°, and 180°, rotating either right or left hand.

Please Note: do not drop the senor. Do not force the rotating head against the internal stops. Avoid pushing the rotating head into the sensor. A force over 1lb applied axially to the shaft may destroy the motor and gearbox. Use sensing probes with a length of 100mm (4") to 130mm (5") maximum for the WKLR22 type. For the WKLR32 type the probe length may be up to 200mm (8"). The probe may be bent to suit an application. Bend the probe in a vice and not on the sensor. If the maximum length of probe is used switch the controller to the next higher degrees.

Mounting Bracket
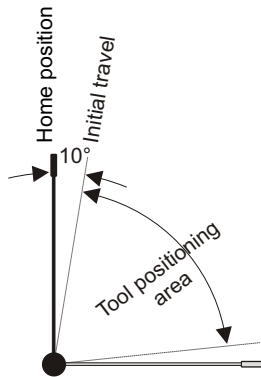
The drawing shows minimum bracket sizes for the 22mm sensor. Increase sizes accordingly when using a 32mm sensor. Use either aluminum or steel. It is important that a slot is made rather than just a bore. After the sensor is in the machine for some time, the thread is gummed up and it is hard to get one nut all the way out. With a slot, cracking one nut slightly will let the sensor slide out easily.
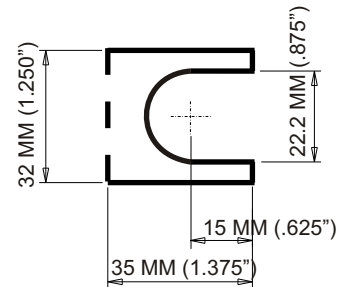
The home stop is the position from where the sensor starts to scan. Adjust the sensor so that the probe moves through at least 10° of travel before it contacts the tool. This initial travel is needed for internal checking. Also set the tool not too close to the end stop. Flexing of the probe may result in a good tool be scanned as "NO OK" if the internal stop is touched at the same time. If the 90° connector of the cable is in the way, loosen the sensor and probe holder and turn sensor body until the cable is out of the way. Fasten again the sensor and also the probe holder at the correct home position.

Please Note: tighten sensor nuts lightly! Tighten the ring nut of the cable until it stops. Hand tighten only. Use cable ties to secure cable to machine parts, leave some slack at the sensor for future adjustments or maintenance. The needle tip protects operators from puncture wounds.

Sensor Maintenance Probe Replacement

The sensors do not need maintenance. Replace probe as needed. To replace steel probe remove probe assembly from sensor. DO NOT FORCE THE PROBE HOLDER AGAINST THE SENSOR'S END STOPS! Remove accumulated dirt from probe holder to avoid interference with the scanning movement.

Please Note: Do not use pressured air to clean sensor around shaft seal. Pressured air will force dirt past the seal into the sensor causing premature failure!

Probe Assemblies

The 22mm sensors are shipped with the 100mm (4") long #9070-B probe assembly. The 32mm sensors are shipped with the 150mm (6") long 9072-B probe assembly. The brass end on the probe protects maintenance personnel from injury. This end cap can also be used to touch the tool. Some of the tools are very aggressive, removing minute chips until the probe is worn through. To extend the wear cycle by a large factor a carbide end is also available.

The WK1 Controller

The WK1 controller interfaces directly with modern PLCs (programmable logical controller). All in and outputs are solid state. The outputs are +24V with maximum 0.1A. The controller snaps conveniently on to DIN rails and is shielded by an impact resistant plastic housing.
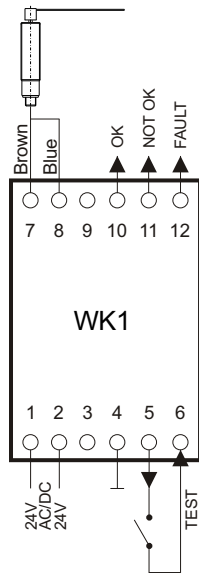
Peripheral Modules

Interfacing a WK1 with older equipment or different supply voltages is a simple task when the Middex peripheral modules are used: power supply PS1 (#9015), power supply with relay interface PSIF1 (#9045), and relay interface only RIF1 (#9040).

Controller Maintenance

No maintenance is needed.

Wiring Details

Please Note: to interface the WK1 controller directly with the machine controller wire the ground of the WK1 with the ground of the PLC. Do not connect anything to unused terminals!

The supply voltage for the controller is 24VDC or 20VAC on terminal #1 and #2 . Other voltages require either a transformer, a power supply PS1, or a power supply/relay interface PSIF1. The "POWER" LED indicates power is on.

To start a test cycle feed a +24V signal from the PLC to terminal #6. For dry contact start use terminal #5 output of +24V and feed back to terminal #6. Keep the "TEST" signal high until the scanning process is finished and the result is processed in the PLC. Dropping the "TEST" signal will drop the outputs and resets the controller. The "TEST" LED indicates that terminal #6 is high.

Connect the brown wire of the sensor cable to terminal #7 and the blue to terminal #8.

Processing the "OK", "NO OK", and "FAULT" signals: after the sensor completes the scanning, the resulting signal +24V is available at the corresponding terminals. If the tool is "OK" terminal #10 is high, if the tool is broken terminal #11 is high. Should the system malfunction terminal #12 and #11 are high. **These outputs are available as long as the "TEST" signal is kept high!** Once the "TEST" signal is released the outputs go low and the controller is reset for the next cycle. The LEDs retain however the last status until a new test cycle is started.

The outputs are protected and several may be combined to one PLC input. Combine only "NO OK" signals since only one will trigger the PLC with a broken tool.

Setup

Mount the WK1 controller in the electrical machine cabinet to protect it from mechanical abuse, dust, and coolant splashes. This will also simplify the wiring.

1. Check that all supply power is switched off and comply with safety regulations.
2. Mount the sensor with its two nuts so that the needle would touch the tool slightly below the tool tip.
3. Check with voltmeter that the supply voltage is within 10% of the nominal voltage. Then hook up the main power.
4. Plug in the cable at the bottom of the sensor.
5. Route the sensor cable away from supply lines and hook it up to the controller (brown to terminal #7, blue to terminal #8).
6. Hook up the signal wires to the controller ("TEST" to terminal #6, "OK" to terminal #10, and "NO OK" to terminal #11).
7. Select the scanning direction R or L, looking on top of rotating probe holder.
8. According to the sensor degrees used, slide the matching slide switch to "ON". Set only one value to the "ON" position. This is s a timer setting and may be changed without damaging the sensor or controller.
9. Remove probe and switch the power on (shaft turns to home stop).
10. Mount the probe in the desired home position by pushing it very lightly all the way down on the sensor shaft. Hold probe down while tightening the grub screw.

LED Status Indication

LED indicate the operation status. The "OK" LED indicates a good tool, the "NO OK" LED a broken tool, the blinking "FAULT" LED a system problem (shorted cable, not able to move initially 10°, jumped the tool). A "FAULT" will also set the "NO OK" LED and "NO OK" output. The "POWER" LED shows supply power to the controller and the "TEST" LED indicates the test signal is high.

Trouble shooting WK1

Sensor does not move: check that the probe holder is not slipping on the sensor shaft. Check if the connecting cable is tight and that no coolant has entered the plug. Check the voltage at the cable plug pin #1 and #2 for approximately 10 to 12VDC. This is the constant voltage applied to the sensor to keep it at the home stop. If the voltage is present then the sensor may be faulty and needs repair or replacement. There is a chance that the controller would not send the voltage to the sensor to sweep, however the duration is so short that a regular volt meter cannot measure it (it would only show a short blip).

Sometimes "OK" sometimes "NO OK" with a good tool: the sensor may have accumulated shavings around the probe holder and prevent it from sweeping freely. Clean sensor and/or set the timing one value higher and allow more time to sweep. The probe may contact the tool sometimes on a high spot and sometimes on a low spot. Allow more travel after the tool position before the end stop is made. The probe acts like a spring and while it contacts the tool it may also make the end stop and generates the "NO OK" signal. Again allow more travel after the tool position before contacting the end stop.

Erratic behavior of the PLC: is usually caused by a faulty "TEST" signal. The signal duration from the PLC is too short and resets the controller before the signals are processed. Increase output signal time on the PLC card. Remember that the "TEST" signal duration controls the output duration. If the "TEST" cycle is started by dry contact replace the contact (relay). A faulty relay may flutter, and corroded contacts increase the resistance across and dragging down the voltage to a point where the controller no longer will work reliably.
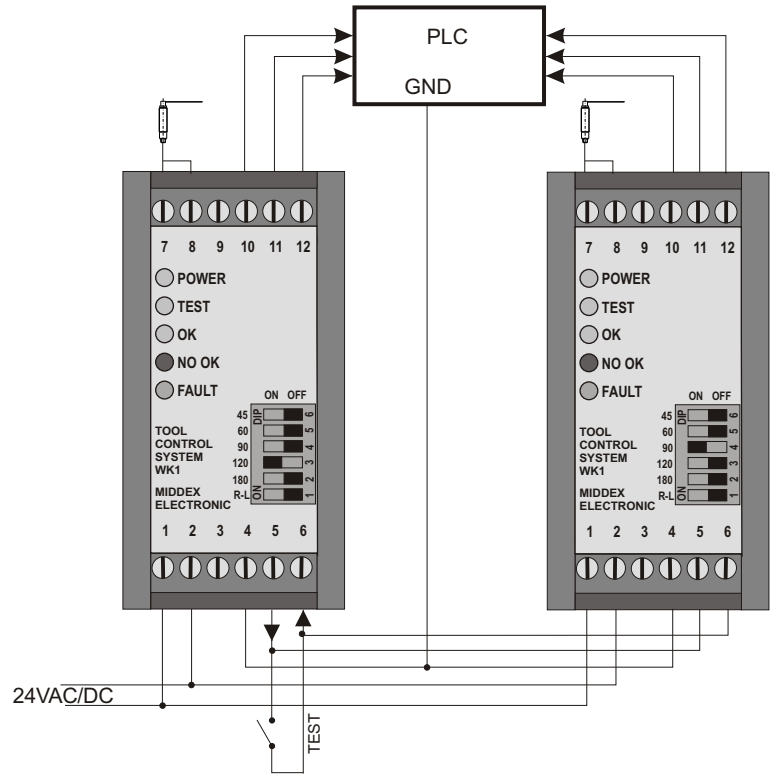
Wiring Examples
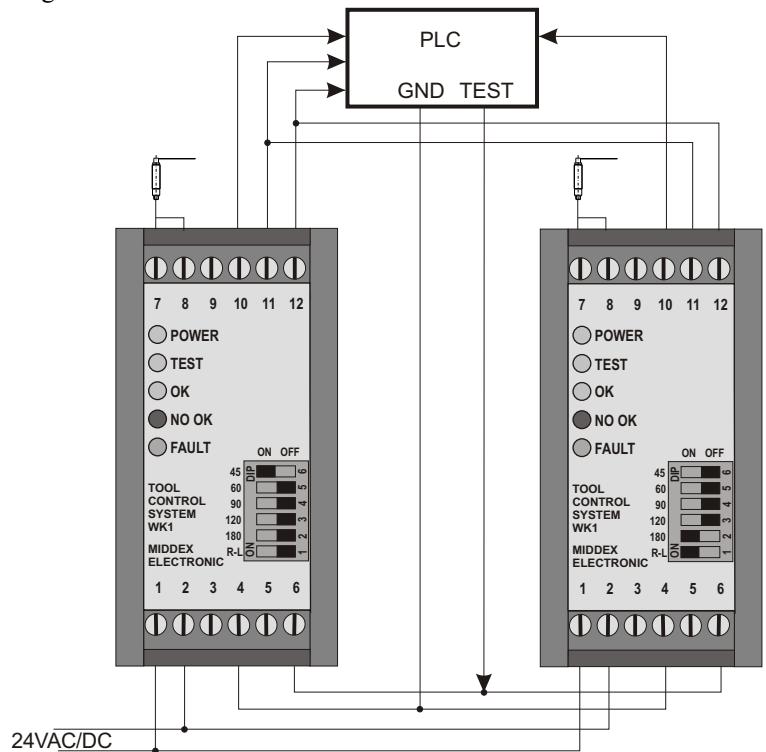
Two WK1 with PLC
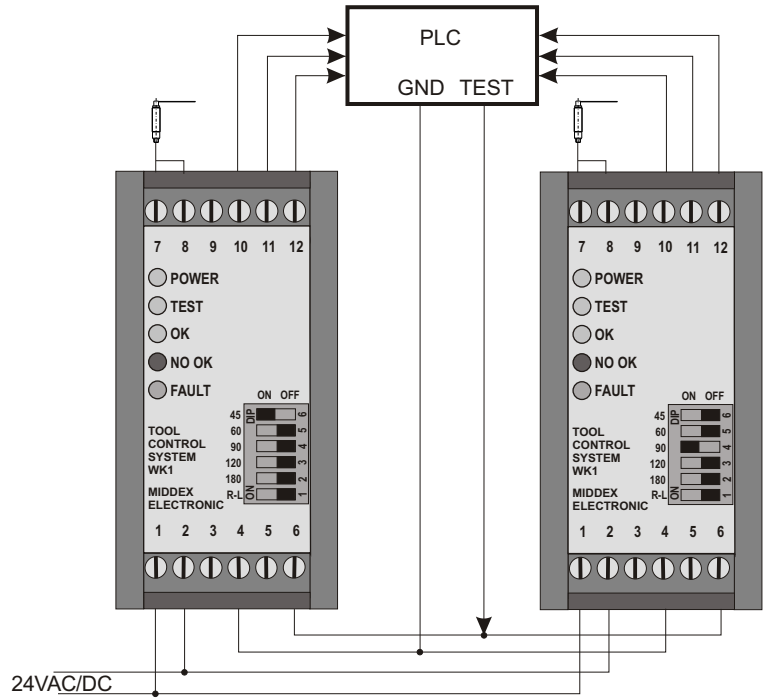
WK1 interfaced with PLC, start signal from PLC, schematic for single or multiple controller wiring.

Two WK1 with PLC

WK1 interfaced with PLC, start signal dry contact, schematic for single or multiple controller wiring.

Two WK1 with PLC

WK1 interfaced with PLC, start signal from PLC, combining signals from terminal #11 and #12, use separate PLC inputs for terminals #10, schematic for multiple controller wiring. **Please note:** above shows hookup of all output signals which may not be needed. Usually the NO OK #11 terminal is used to stop a machine when a broken tool is detected.

WK1 with PS1 and RIF1
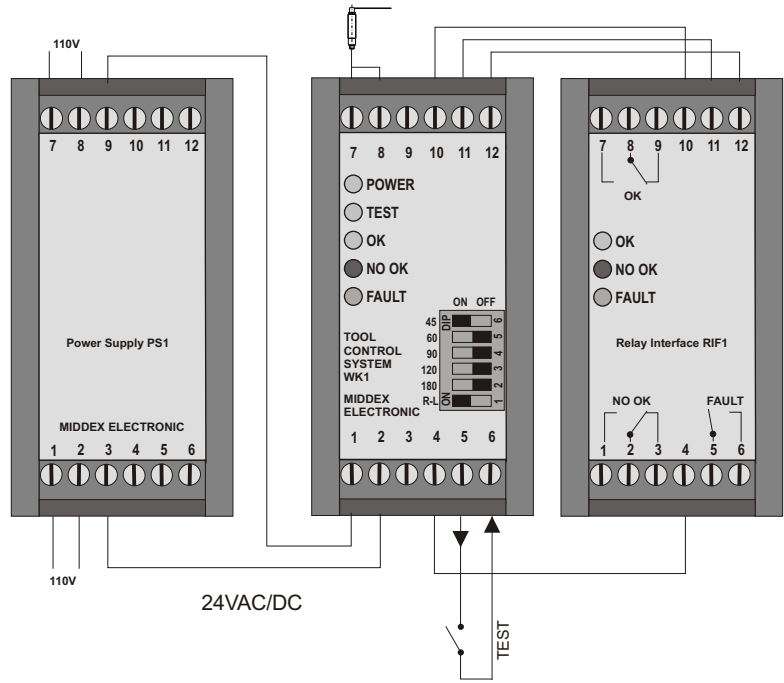
WK1 with power supply PS1 and relay unit RIF1, start signal dry contact, schematic for single controller wiring.

WK1 with PSF1
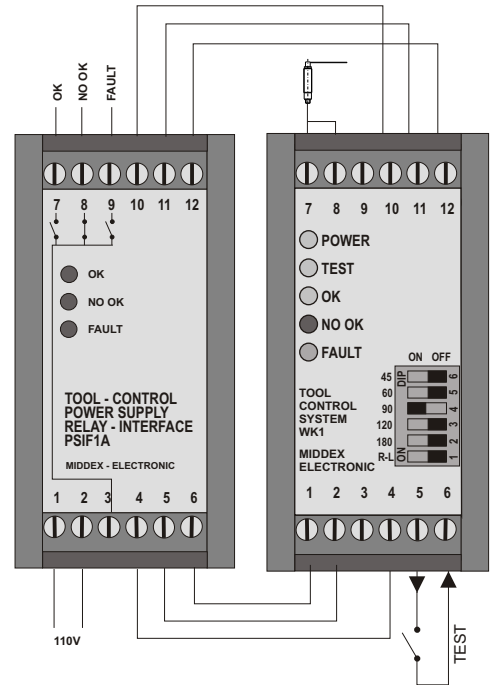
WK1 with power supply/relay interface PSIF1, start signal dry contact, schematic for single controller wiring.

Technical Data

Controller

Protection:	IP20
Mounting:	EN rail (DIN rail)
Supply voltage Ub:	20-28VDC, 15-22VAC
Current draw:	0.25-0.45A (output load at 0.1A)
Output current (# 10 to #12):	0.1A maximum
TEST signal voltage:	8-28 VDC
Input resistance TEST:	4k7
Temperature range:	0° to +50°C (32° to 122°F)

Sensor Cycle Times

Scanning angle 45°:	0.30 seconds
Scanning angle 60°:	0.35 seconds
Scanning angle 90°:	0.40 seconds
Scanning angle 120°:	0.50 seconds
Scanning angle 180°:	0.60 seconds
Temperature range:	0° to +70°C (32° to 158°F)

Order Information

Item	Type	Order #
Controller WK1:		9011
Sensor 22mm diameter, 45° rotation	WKLR22-45	9050
Sensor 22mm diameter, 60° rotation	WKLR22-60	9051
Sensor 22mm diameter, 90° rotation	WKLR22-90	9052
Sensor 22mm diameter, 120° rotation	WKLR22-120	9053
Sensor 22mm diameter, 180° rotation	WKLR22-180	9054
Sensor 32mm diameter, 45° rotation	WKLR32-45	9060
Sensor 32mm diameter, 60° rotation	WKLR32-60	9061
Sensor 32mm diameter, 90° rotation	WKLR32-90	9062
Sensor 32mm diameter, 120° rotation	WKLR32-120	9063
Sensor 32mm diameter, 180° rotation	WKLR32-180	9064
Cable 3m (9') 90° connector		9026
Cable 5m (16') 90° connector		9027
Cable 10m (32') 90° connector		9028
Cable 20m (65') 90° connector		9038
Cable 3m (9') straight connector		9035
Cable 5m (16') straight connector		9036
Cable 10m (32') straight connector		9037
Power supply, 110/220Vac	PS1	9015
Relay interface only	RIF1	9040
Power supply & relay interface 110Vac	PSIF1	9045
Probe assembly 100mm (4" needle) brass end (old #9070-H)		9055
Probe assembly 100mm (4" needle) carbide end	22mm sensors	9070-H
Probe assembly 130mm (5" needle) brass end		9071-B
Probe assembly 130mm (5" needle) carbide end		9071-H
Probe assembly 150mm (6" needle) brass end		9072-B
Probe assembly 150mm (6" needle) carbide end	32mm sensors	9072-H
Probe assembly 200mm (8" needle) brass end		9073-B
Probe assembly 200mm (8" needle) carbide end		9073-H

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