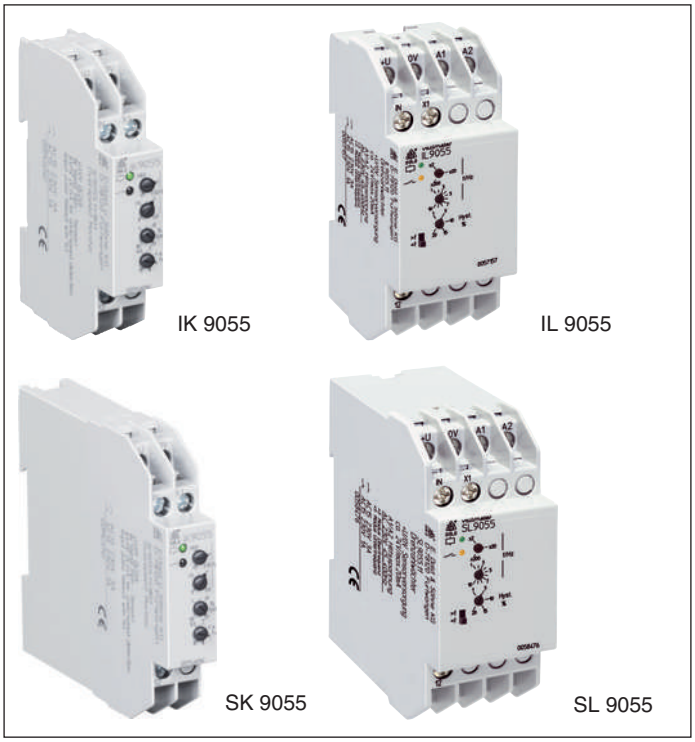
VARIMETER
Speed Monitor
IK 9055, IL 9055, SK 9055, SL 9055

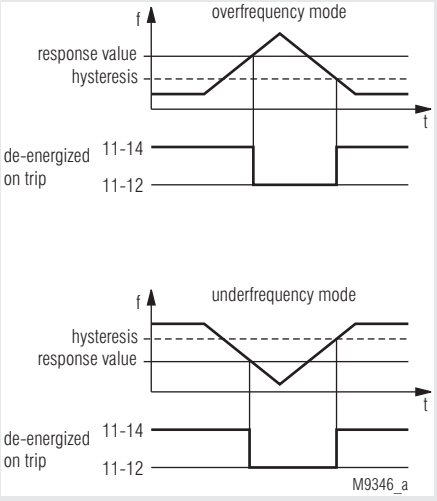
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Your Advantage
- Protection of persons, machines and products
- Easy setting
- Universal input, for configuration of different sensors (PNP, NPN, 2-wire, contact, voltage)

Features
- According to IEC/EN 60 255-1
- Detection of over- or underspeed or frequency, function selectable
- 3 selectable ranges for frequency or speed, adjustable tripping value
- Ranges up to 10 kHz (≙ 600.000 ipm) available,therefore suitable for turbines, centrifuges and similar applications
- Adjustable hysteresis
- Input also suitable for SKF sensor bearings
- As option for Namur sensors
- As option for permanent magnet sensors
- As option with adjustable switching delay/start up delay
- On request with manual reset
- IK 9055 and SK 9055: compact version for DC 24 V auxiliary supply
- IL 9055 and SL 9055: for auxiliary supply up to AC 400 V with galvanic separation to sensor input
- De-energized on trip (Energized on trip on request)
- LED indicators for auxiliary supply, sensor pulses and contact position
- 1 changeover contact (2 changeover on request)
- Devices available in 2 enclosure versions:
- IK/IL 9055: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
- SK/SL 9055: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- IK 9055, SK 9055: width 17.5 mm
  IL 9055, SL 9055: width 35 mm

Function Diagram



Approvals and Markings

CE
C US
Canada / USA
* see variants

Applications

Speed monitoring on rotating machine parts, monitoring of cyclic movements, general monitoring of pulse sequences (transpor-tation, conveyors production systems), monitoring of pulse frequency (e.g. flow sensors, anemometers), pulse monitoring on railway rolling stock

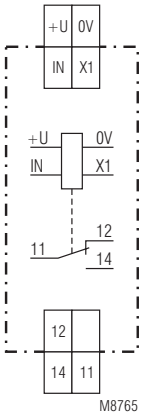
Function

The frequency to be monitored is connected to the input terminal IN. It is compared to the adjusted tripping value.

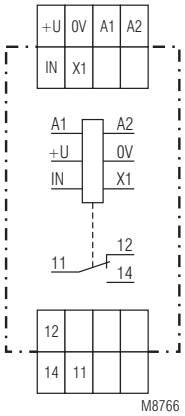
In overfrequency mode, the output relay switches into alarm position when the preset response value is exceeded. When the system frequency once more falls below the response value minus the preset hysteresis, the output relay will switch back into normal position.
In underfrequecy mode, the output relay switches into alarm position when the actual value falls below the preset response value. When the system frequency once mor exceeds the response value plus hysteresis, the output relay will switch back into normal position.
If de-energized on trip is selected, the output relay is energized (11-14 closed) in normal status. If energized on trip is selected, the output relay is energized (11-14 closed) in alarm status.

All technical data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.

Circuit Diagrams



IK 9055, SK 9055



IL 9055, SL 9055

Connection Terminals

Terminal designation	Signal description
U+, 0V	Supply voltage device and sensor
A1, A2 (only at IL/SL)	Auxiliary voltage input
X1, IN	Connection sensor (see application example)
11, 12, 14	Changeover contact

Indicators

Green LED: On, when only auxiliary voltage connected to A1-A2, intermittent red/ green flashing when pulses are on the input IN

Yellow LED: On, when the output relay is energized (contacts 11-14 closed)

Notes

To the universal input of the speed monitor (terminals +U, X1, IN, 0V) a wide range of different sensors can be connected (capacitive, inductive, ultrasonic, hall effect, optical, reed, etc.) The input is suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660, part 208).
Depending on the type of sensor (3-wire PNP or NPN, 2-wire, contact, voltage) the connection is made to different terminals (see Connection Examples).
The models IL and SL 9055 have a galvanic separation between Input Circuit (+U, X1, IN, 0V) and auxiliary supply (A1, A2 e.g. 230 V AC).
24 V DC with up to 20 mA is provided on the terminals U+/0V for the supply of the sensor.
If sensors with higher power consumption are used, the model IK and SK 9055 is suitable, where the sensors and the speed monitor are supplied by DC 24 V from an external power supply.
The speed monitors can be operated with SKF sensor bearings. Sensor bearings include ball bearing and speed sensor in a compact way. The actual sensors are hall effect sensors with NPN output. The connection is made as with NPN proximity sensors.
The model /200 is optimised for Namur proximity sensors according to IEC 60 947-5-6 (VDE 0660 part 212, previously EN 50 227/ DIN 19 234). Namur sensors are 2-wire sensors with defined current in on and off state.
The model /300 is designed to connect permanent magnet sensors. Permanent sensors are simple, robust 2-wire sensors without voltage supply and electronic circuits. They generate an induced voltage while the permanent magnet passes. They are very cost effective and can be used also with high temperature and hard ambient conditions.

Monitoring indicator of sensor input
The upper 2-coloure LED shows the connected supply voltage and the status of the sensor:

Green:	input IN on LOW level
Red:	input IN on HIGH level
Green/Red:	pulses on input IN

Several devices on one sensor
A parallel connection of several monitors to one sensor is possible without problems on the universal input, when several tripping values are required or a range between two limits should be monitored. The corresponding terminals are connected in parallel.

Monitoring function over- or underfrequency
The function can be changed by a slide switch on the front of the unit. Energized on trip or de-energized on trip remains the same when changing the function, also the tripping value remains unchanged. No calculations with hysteresis are necessary.

Hysteresis setting
When the setting value is very low in the lowest range, the hysteresis should not be adjusted to the minimum in order to avoid cycling of the output relay.
In the operating mode underfrequency (<f) at setting values near to the end of the rage the hysteresis can only be set to 4 ... 10 % due to the internal circuit. When there are problems, the next higher range should be selected.

Reaction time
The unit work with an integrating measuring principle, where the mean value of several input pulse periods is calculated. This avoids problems with interference pulses, but the reaction time gets longer. The reaction time relates to the lowest adjustable frequency on the actual unit.

An approximate calculationis: Time constant $(\tau) \approx \frac{2.5}{f_{min}}$

Notes

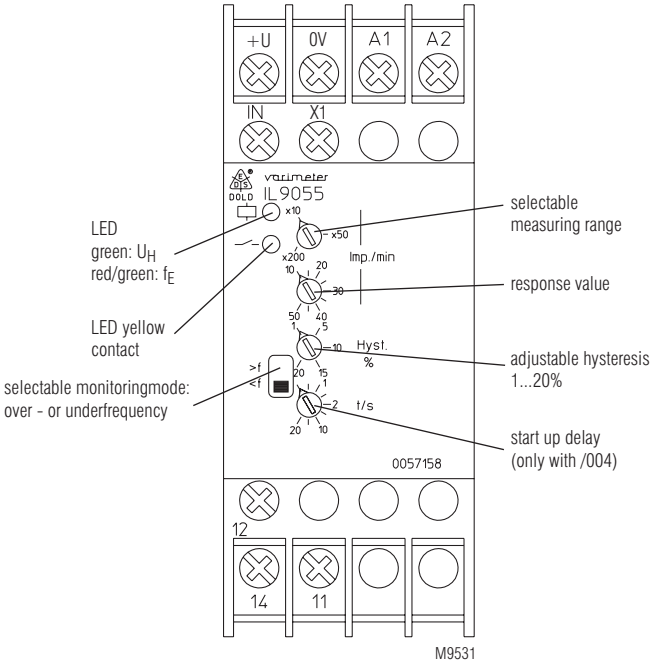
The time constant (τ) is the time after which a change of the input frequency with 63 % influences the calculation. If the input frequency before the change is near to the switching value or the change of the frequency is very low, the reaction time can be shorter then the time constant. The technical data will show always the time constant.
Special models with shorter time constant (limited frequency range) on request.

Maximum input frequency, minimum pulse and space time
Every frequency measuring device detects input pulses only up to a certain maximum input frequency. (This is also a result of a proper interference suppression.) If the input frequency is higher then the maximum value, the input pulses are not longer detected. The monitor detects frequency 0.

The maximum frequency is always much higher then the maximum setting value of the highest setting range (see technical data).
Also the maximum switching frequency of the sensors must be observed. In addition every frequency input needs a certain minimum pulse and space duration of the connected sensor to react properly. This is very important with high frequency and a low or high pulse/space ratio (e.g. a small active area on big diameter or a small gap on big diameter at high rotation speed). If a frequency near to the maximum speed should be detected a pulse/space ratio of 1:1 should be provided by designing the rotating part accordingly. Pulse time is the time the high signal is present at te IN terminal, space time is the time the low signal is present on the IN terminal.
When using PNP sensors or contacts connected to +U the pulse time is identically with the on time of the sensor or contact.
The minimum pulse or space time are very short on these modules, so that most applications are uncritical (see technical data).

Variants with delay or start up delay
Devices with adjustable switching delay or start up delay can be made. The start up delay is started when connecting the auxiliary supply, during this time no frequency mesurement is done. This may be useful in application for underspeed monitoring when the speed monitor is started up with the motor which needs some time to get on operation speed. Without start up delay there would be an alarm when before the motor is on speed. Compared with the standard switching delay a start up delay has the advantage that is only work one time on start up, but after that a change is detected immediately. If the start up delay is not required, (e.g. on function overspeed), the potentiometer "t/s" is set to left end (minimum).

Setting



Technical Data

Input Circuit

Universal input: for PNP-, NPN-, 2-wire sensors, contacts and voltage suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660 part 208)

IK 9055, SK 9055: sensor supply by external auxiliary voltage DC 24 V

IL 9055, SL 9055: built in power supply approx. DC 24 V, max. 20 mA

Max. residual current
of 2-wire sensors: 2 mA (OFF)

Max. voltage drop
of 2-wire sensors: 8 V (ON)

Voltage drive
input resistance: approx. 17 kΩ

Threshold Low
IK 9055, SK 9055: approx. 9.2 V
IL 9055, SL 9055: approx. 8.4 V

Threshold High
IK 9055, SK 9055: approx. 11 V
IL 9055, SL 9055: approx. 10.2 V

NAMUR Input
IK 9055/200, SK 9055/200,
IL 9055/200, SL 9055/200: für NAMUR-sensors according to IEC/EN 60 947-5-6 (VDE 0660 part 212) (previously EN 50227/DIN 19234)

No-load operation voltage: approx. 8.2 V
Input resistance: 1 kΩ
Short circuit current: approx. 8 mA
Switching thresholds: Low approx. 1.5 mA
High approx. 1.8 mA

Input

IK 9055/300, SK 9055/300,
IL 9055/300, SL 9055/300: for permanent magnet sensors

Input resistance
at f < 100 Hz: approx. 50 kΩ
at f = 2 kHz: approx. kΩ

Input sensitivity
standard: approx. 50 $mV_{eff.}$ (at f < 500 Hz)
high: approx. 20 $mV_{eff.}$ (at f < 250 Hz)

Max. input voltage: 80 $V_{eff.}$

Monitoring mode: overfrequency („>f“) or underfrequency („<f“) selectable via slide switch

Response value: frequency ranges each 3-fold, selectable via rotary switch

Frequency range:			
100 ... 500	50 ... 500	2 ... 20	10 ... 100
500 ... 2500	500 ... 5000	20 ... 200	100 ... 1000
2000 ... 10000	5000 ... 50000	200 ... 2000	1000 ... 10000
Impulse/min	Impulse/min	Hz	Hz
Fineadjustment range:			
infinitely 1:5	infinitely 1:10	infinitely 1:10	infinitely 1:10
Max. Input frequency (Pulse: break = 1:1):			
5 kHz	5 kHz	5 kHz	15 kHz
Min. pulse- and breaktime:			
150 µs	150 µs	150 µs	50 µs
Time constant τ measuring circuit:			
approx. 1.4 s	approx. 3 s	approx. 1.4 s	approx. 0.2 s

Hysteresis
adjustable infinitely: 1... 20 % of the adjusted response value

Start up delay
IK 9055/004, SK 9055/004,
IL 9055/004, SL 9055/004
adjustable logarithmically: 0.1 ... 20 s

Technical Data

Auxiliary Circuit

IK 9055, SK 9055
(terminal connection +U/0V):
Nominal voltage U_H: DC 24 V
Voltage range: 19.2 ... 30 V
Nominal consumption: max. approx. 0.5 W

IL 9055, SL 9055
(terminal connection A1/A2):
Nominal voltage U_H: AC 24 V, 48 V, 230 V (others on request)
Voltage range: 0.8 ... 1.1 U_H
Nominal consumption: approx. 4 VA
Frequency range: 45 ... 400 Hz

Output

Contacts: 1 changeover contact
Thermical current I_{th}: 4 A
Switching capacity
to AC 15
NO contacts: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contacts: 1 A / AC 230 V IEC/EN 60 947-5-1
nach DC 13
NO contacts: 1 A / DC 24 V IEC/EN 60 947-5-1
NC contacts: 1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A / 230 V: 1.5×10^5 switching cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 4 A gG / gL IEC/EN 60 941-5-1
Mechanical life: ≥ 30×10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 20 ... + 60°C
Storage: - 20 ... + 60°C
Altitude: < 2,000 m
Clearance and creepage distances
rated impulse voltage/
pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation
80 MHz ... 1 GHz: 20 V/m IEC/EN 61000-4-3
1 GHz ... 2 GHz: 10 V/m IEC/EN 61000-4-3
2 GHz ... 2.7 GHz: 1 V/m IEC/EN 61000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltage
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, Frequency 10...55Hz, IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: DIN EN 50 005

Wire connection: DIN 46 228-1/-2/-3/-4
Cross section: 2 x 0.6 ... 2.5 mm² solid or
2 x 0.28 ... 1,5 mm² stranded wire with and without ferrules
Stripping length: 10 mm
Wire fixing: Plus-Minus-terminal screws M3,5 with self-lifting clamping piece
Fixing torque: 0.8 Nm
Mounting: DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory

Technical Data

Weight

IK 9055:	approx. 65 g
SK 9055:	approx. 85 g
IL 9055:	approx. 140 g
SL 9055:	approx. 160 g

Dimensions

Width x height x depth

IK 9055:	17.5 x 90 x 59 mm
SK 9055:	17.5 x 90 x 98 mm
IL 9055:	35 x 90 x 59 mm
SL 9055:	35 x 90 x 98 mm

CSA-Data

Nominal voltage U_N:

IK 9055, SK 9055:	DC 24 V
IL 9055, SL 9055:	AC 24 V, AC 48 V, AC 230 V

Ambient temperature: -20 … +60°C

Switching capacity: 3A 240Vac

Wire connection: 60°C / 75°C copper conductors only
AWG 20 - 14 Sol Torque 0.6 Nm
AWG 20 - 16 Str Torque 0.6 Nm

Technical data that is not stated in the CSA-Data, can be found in the technical data section.

Classification to DIN EN 50155 for IK 9055

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

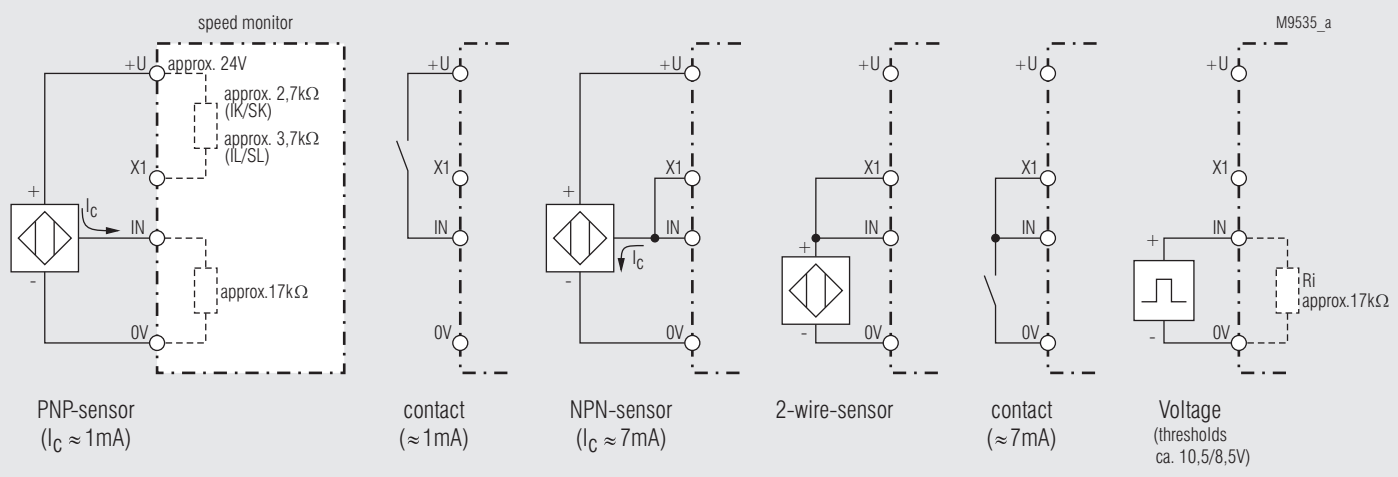
IK 9055.11/60 50 ... 50000 lpm U_H DC 24 V Hysteresis 1 ... 20 %
Article number: 0059786
- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 50 ... 500 lpm, 500 ... 5000 lpm, 5000 ... 50000 lpm
- Response value unfinitely adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H: DC 24 V
- De-energized on trip
- Output: 1 changeover contact

IL 9055.11/60 2 ... 2000 Hz U_H AC 230 V Hysteresis 1 ... 20 %
Article number: 0057157
- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 2 ... 20 Hz, 20 ... 200 Hz, 200 ... 2000 Hz
- Response value unfinitely adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H: AC 230 V
- De-energized on trip
- Output: 1 changeover contact

Variants

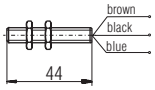
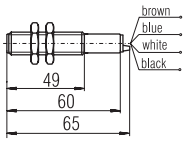
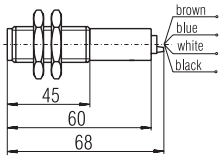
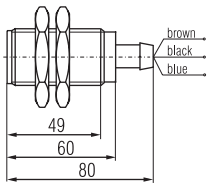
IK 9055. _ _ /60, SK 9055._ _ /60, IL 9055._ _ /60, SL 9055._ _ /60:	with CSA-approval
IK 9055.11/004, SK 9055.11/004, IL 9055.11/004, SL 9055.11/004:	with adjustable start up delay 0.1 ... 20 s
IK 9055.11/200, SK 9055.11/200, IL 9055.11/200, SL 9055.11/200:	input for NAMUR sensors
IK 9055.11/300, SK 9055.11/300, IL 9055.11/300, SL 9055.11/300:	input for permanent magnet sensors

Application Example Universal Input



Note: For IK-models the auxiliary voltage (DC 24 V) must be additionally connected to terminals +U/0V

Initiators (proximity sensors), inductive

Type	NA 5001.01.10 pnp NA 5001.01.20 npn	NA 5002.01.34 pnp/npn	NA 5005.01.34 pnp/npn	NA 5010.01.10 pnp NA 5010.01.20 npn
Dimensions	 M8x1 SW13 M7266	 M12 x 1 SW 17 M7267	 M 18 x 1 SW 24 M7268	 M30 x 1,5 SW 36 M7269
Enclosure	Metal	Metal	Metal	Metal
Switching distance S_n	1 mm	2 mm	5 mm	10 mm
Switching frequency	5 000 Hz	1 000 Hz	300 Hz	200 Hz
Hysteresis	2 ... 10 %			
Repeat accuracy	5 %			
Voltage range	10 ... 30 V			
Residual ripple	< 10 %			
Continuous current	≤ 200 mA	≤ 100 mA	≤ 100 mA	≤ 400 mA
Output	.10 pnp NO .20 npn NO	.34 pnp NO + npn NO	.34 pnp NO + npn NO	.10 pnp NO .20 npn NO
Indication of output state	LED			
Ambient temperature	- 25 ... 70°C			
Temperature influence	10 %			
Degree of protection	IP 67			
Connection wire	2 m			
Fixing torque	4 Nm	15 Nm	40 Nm	100 Nm
Weight	45 g	70 g	120 g	270 g

Connection Table IK 9055, SK 9055, IL 9055, SL 9055

Type	Wire	Terminal on IK / SK / IL / SL 9055
NA 5001.01.10	brown +	+ U
	blue -	0 V
	black NO	IN
NA 5002.01.34 NA 5005.01.34	brown +	+ U
	blanc +	+ U
	blue -	0 V
	black NO	IN
NA 5010.01.10	brown +	+ U
	blue -	0 V
	black NO	IN

Connection Table IK 9055, SK 9055, IL 9055, SL 9055

Type	Wire	Terminal on IK / SK / IL / SL 9055
NA 5001.01.20	brown +	+ U
	blue -	0 V
	black NO	IN, X1
NA 5002.01.34 NA 5005.01.34	brown +	+ U
	blanc NO	IN, X1
	blue -	0 V
	black -	0 V
NA 5010.01.20	brown +	+ U
	blue -	0 V
	black NO	IN, X1