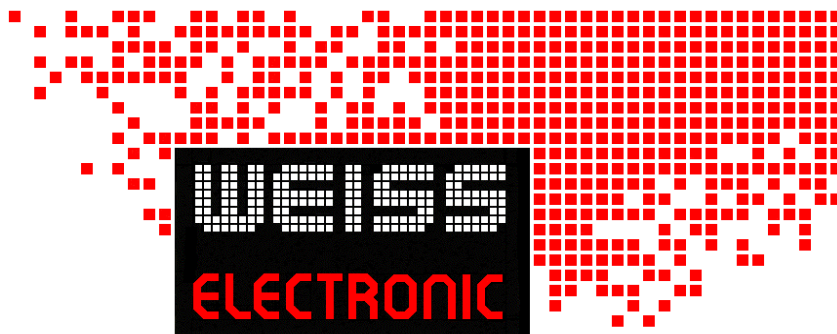
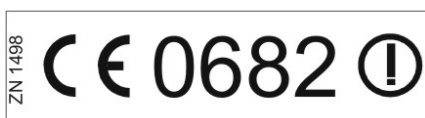




Manual

IG745/3 4-Channel Induction Pulse Generator

Weiss-Electronic



Contents

1 Product Description	4
1.1 General Description	4
1.2 Survey of the Most Important Product Specifications	4
2 Installation of the IG745/3	5
2.1 Installation and Starting-Up of the Device	5
2.2 Hardware Requirements for the Operation	5
2.3 Installation of the IGBT-Software	6
3 Operation of the IG745/3	6
3.1 Short Survey of the Operation with IGBT	6
3.2 Operation with Hand Terminal HT2000 resp. PC-Terminal Program	9
4 Display and Service Elements	10
5 Balancing and Error Diagnosis	11
5.1 Balancing	12
5.2 Error Detection and Error Removal	11
6 Parameters and Functioning	12
6.1 Meaning of the Channel Parameters	12
6.1.1 Sensitivity / Measuring Time	12
6.1.2 Frequency Range	12
6.1.3 Holding Time	13
6.1.4 Channel Function	13
6.1.5 Switching-On / -Off Delay	13
6.1.6 Oversampling	13
6.1.7 Channel-Flags	14
6.2 Meaning of the Detector Parameters	14
6.2.1 Detector-Flags	14
6.3 Meaning of the Channel Diagnosis Values	15
6.3.1 Channel Status	15
6.3.2 Error Code	15
6.3.3 Number of Balancings	15
6.3.4 Frequency	15
6.3.5 Switching Threshold	15
6.3.6 Classification Switching Threshold	15
6.3.7 Maximum Attenuation	15
6.3.8 Last Amplitude	15

6.4 Meaning of the Detector Diagnosis Values	16
6.4.1 Error Code, Reset Counter	16
6.4.2 Cycle Time	16
6.5 Description of the Special Functions	17
6.5.1 Classification Function	17
6.5.2 Direction Logic	19
6.5.3 Synchronization	20
7 Appendix	21
7.1 Technical Data	21
7.2 Pin Connections	24
7.2.1 Connector Strip	24
7.2.2 RS232-Port Connection Cable	24
7.3 Parameter Table / Default Setting	25
7.4 Diagnosis Values Table	26
7.5 IGBT-Abbreviations	26

1 Product Description

1.1 General Description

IG745/3 is an induction pulse generator for the connection of up to 4 induction loops. It is connectionwise compatible with the previous models IG745 and IG745/2, as well as functionally compatible with these devices including further options of setting.

The detector operates the loops one after the other in a given succession (Multiplex-Process), i.e. only one loop at a time is connected to the LC-oscillating circuit as inductivity L. Since only one loop is current-filled, the channels of a detector cannot mutually influence one another. The reaction times and cycle times of the detector, given in the technical data, result by the Multiplex-Process.

If a metal part is in the range of effectiveness of the connected induction loop, a change in frequency of the LC-Oscillator by the lowered loop inductivity will result, too. This change is detected by the evaluation switching of the detector and is reported as busy-signal at the switching outputs of the channel (relay/opto-coupler and Open Collector) during an overrange of the switching threshold. Different output functions can be selected here, e.g. presence signal and pulse signal.

The setting of the detector does not happen via switches or jumpers, but via the serial RS232-port at the front part of the device. To achieve this, the COM-port of the PC has to be connected with this port via a DSUB-cable. The PC-operating program **IGBT** offers the user a comfortable surface for the modification and display of the detector parameters. The set parameters are not temporarily stored in an EEPROM.



Warning



The loop detector IG745/3 is only designed for operation by personnel being specially trained in the field of traffic detection devices.

Inexpert operation of IG745/3 can lead to unexpected reactions of the systems activated by the detector.

1.2 Survey of the Most Important Product Specifications

- connection- and function-compatible with IG745 resp. IG745/2
- power supply: 24 V DC and AC, optional 5 V DC, 12 V DC
- wide inductivity range: 20 μ H - 2000 μ H
- EuroCard plug-in (100 mm x 160 mm) for the operation in 19"-components
- loop activation in Multiplex-Process
- low power consumption
- comfortable operation with PC-operating program IGBT via RS232, storage of device- or user-specific parameter sets via IGBT, alternative: PC-Terminal Program or Weiss-Hand Terminal
- variable parameterization enables operation in nearly all fields of induction loop technology
- storage of the operating parameters in EEPROM
- channel parameters:
 - frequency
 - sensitivity
 - measuring time
 - holding time
 - channel function: Off, presence signal, pulse signals during entry or exit, permanent signal
 - switching-on / -off delay
 - oversampling
 - bus detection resp. car / lorry classification
- permanent loop control to detect short-circuit or open loops
- automatic adjustment of temperature drifts
- high interference protection by frequency setting, oversampling and the possibility of detector synchronization.

- automatic balancing after switching-on, reset or parameter modification
- direction logic
- processor with Watchdog- and Power-Fail surveillance
- special options:
 - opto-coupler
 - electronical relay
 - RS485-port
 - traffic jam detection
 - speed measurement

2 Installation of the IG745/3

2.1 Installation and Starting-Up of the Device

IG745/3 is designed for the integration into 19"-components with plug-in connections according to DIN41612 (types F or C). Wire the components according to their pin connections (see appendix). The loop connections have to be specially taken into account. They also have to be twisted inside the component! When connecting the loops, the instructions of loop-laying WEISS-ELECTRONIC have to be matched (available on demand).

The specification of the supply voltage can be found in the technical data. Please note that the DC-input (d32/z32 resp. c32/a32) has no polarization protection. If you need a polarization protection during DC-supply, use the AC-input (dbz22/dbz30 resp. abc22/abc30)!

The detector has a fine lightning protection. To realize a multi-layered lightning protection, a coarse protection has to be used in addition. The coarse protection **FP_V1_2** of WEISS-ELECTRONIC can be mounted onto a hat rack in the switch cabinet. Varistors should not be used in any case, since they influence the function of the detector by non-constant capacities.



Warning



Faulty connection of the device can lead to its malfunction or destruction. With faulty installation, WEISS-ELECTRONIC does not grant any guarantee for the device function, nor any responsibilities. The general rules of electro-engineering have to be matched when connecting the detector.

After the first start of the device, a balancing of the connected loop inductivity is made. Short-circuit or open loop connections are indicated by the collective error message-LED „ERROR“ and the blinking of the faulty channel-LED (see also chapter 5.2). The „FUNC.“-LED is blinking in normal operation with a frequency of 1 Hz.

2.2 Hardware Requirements for the Operation

The operation of IG745/3 happens either with a Personal Computer (PC) or with a **Weiss-Hand Terminal HT2000** (HT) via the front RS232-port.

The PC has to be equipped at least with:

- IBM-compatible Personal Computer (PC)
- Processor: 286 or higher
- RAM: minimum 640 kb
- Graphics Card: VGA or higher
- Floppy Disk: 3.5"
- 1 free and serial port (COM1 .. 4)
- MS-DOS 3.3 or higher
- hard disk: approx. 400 kb memory left.

With the PC-operation, the front RS232-port of IG745/3 with a 9-pin serial DSUB-connection cable (order type: **KA_V24**) is connected to the COM-port of the PC. The pin connection of this cable can be found in chapter 7.2.2.

In addition to the used COM-port of the PC, the following port parameters have to be set in the program IGBT:

- baud rate: 4800 baud
- 8 data bits, 1 start-, 1 stop bit
- no parity.

With an operation per hand terminal (order type: **HT2000**), a special kind of adapter is needed (order type: **ADA745_3**), that has to be switched between the connector of IG745/3 and the connector (FEMALE) at the HT-cable. Further settings are not necessary, since the above mentioned port parameters of **HT2000** have been set firmly.

Certainly, the parameters can be provided by using a PC-terminal program (e.g. Windows-Terminal-Program). This corresponds to the operation via hand terminal and is advisable like the latter if the IGBT cannot be used. The above mentioned port parameters have to be set and the given cable has to be used. Further information to this operation follows in chapter 5.2.

2.3 Installation of the IGBT-Software

The software **IGBT** (Induktionsimpuls-Geber-Bedien-Terminal = Induction pulse-Generator-Operation-Terminal) enables the simple parameterization of IG745/3 with a PC (e.g. Laptop or Notebook). It is available free of charge through Weiss-Electronic and it should be used as the standard operation of IG745/3.

For the installation of the software, you only have to copy the files of the delivered disk onto the hard disk of your PC. If you use the file

install.bat

IGBT will be installed in the directory

c:\igbt

of your hard disk. Further information for the operation of IGBT can be found in the IGBT-manual.

3 Operation of IG745/3

3.1 Short Survey of the Operation with IGBT

The IGBT represents the parameters in different windows. One window at a time is created for channel- and device-specific data. In these windows, settable and non-settable (diagnosis) parameters are differentiated. The non-settable parameters are gained by the detector; they cannot be directly modified by the user and they contribute to the diagnosis. Examples for that are the set frequency, the channel status (channel diagnosis accordingly) or the reset counter (detector diagnosis).

Apart from these windows, the IGBT also contains a terminal window, in which the serial RS232-communication is logged. This window also enables the simulation of the HT-operation (description see chapter 3.2).

Below the menu bar, a status line can be found, in which, during polling via menu point

Detector Type...,

the following detector data (set by WEISS-ELECTRONIC) are inserted:

- detector type, e.g. IG745_3
- **Series-Number**, e.g. SN123456
- country code of the HT-operation, e.g. D (German)
- version type of the detector software, e.g. V1.23
- date of the detector software, e.g. 01/10/97 (10.01.97).

The current settings can be polled from the detector with the command

Poll Parameter Settings...

and the parameter windows can so be updated.

After parameters have been modified in the windows of IGBT, this information has to be transferred to the detector with the command

Parameters - Transfer to the Detector...

All parameters of the selected channels are transferred to the detector one after the other, a balancing of each channel is carried out, the current parameters are transferred back to the IGBT and the parameter window are updated with this information.



Attention



The user has to guarantee with “Poll Settings...” that the parameters represented in the IGBT really correspond with the set parameters of the detector. Non-corresponding parameter sets can lead to malfunctions or to unintentional settings.

Further menu points are:

Parameter Menu:

- **Open**
This command polls all detector data and opens the parameter windows with the current data.
- **Basic Settings...**
With this command, the parameters of the selected channels and the device parameters are set to basic values. The basic settings defined in the file `igbt.dev` are set in the parameter windows and they are automatically transferred to the detector if the corresponding function is activated in the option „Transfer to the Detector...“. Otherwise, the command „Transfer to the Detector...“ has to be used. The user therefore has the possibility of defining an individual basic setting by editing the file `igbt.dev`. The delivery status of `igbt.dev` corresponds with the default setting. Further information on the definition of the basic setting can be found in the IGBT-description.
- **Default Settings...**
With this command, the detector is reset into delivery status (default setting). After the detector has taken over the internally saved default setting, the parameter windows of the IGBT will be automatically updated. The values of the default setting are given in the appendix. Three channel- and device-specific parameters can be reset separately.
- **Copying into Channels...**
With this command, the parameters of a channel can be copied into the windows of the other corresponding channels. To update the detector data, the command „Transfer to the Detector...“ has to be used afterwards!
- **Store...**
The parameters set in the parameter windows can be stored in a file with the extension `.igb` (default) with this command. The parameter sets of the detector have to be polled from the detector with the command „Poll Settings...“ before that! The default file name corresponds with the serial number (example: SN123456), if the latter is displayed in the status line. With that, an exact classification parameter set - device is possible later on.
- **Load...**
This command reads the parameter sets provided with „Store...“ and updates the parameter windows. To update the detector data, the command „Transfer to the Detector“ has to be used afterwards!
- **Reset Error Codes**
The reset counters and reset error codes are reset.

Terminal Menu:

- **Open**
This command opens the terminal window, if not yet existing.
- **Stop / Release**
The command „Stop“ freezes the terminal window in its current status and the buffer contents can be viewed with the help of the arrow keys. „Release“ renders updating of the terminal window possible again.
- **DeLete**
This command deletes the buffer of the terminal window. The buffer contents are larger than the represented area.

Options Menu:

- **Port...**
With this menu point, the used port (COM 1 ... 4) and the port parameters of the PC can be set.
- **Video...**
Here, screen line resolution and representation (color, black/white, etc.) are set.
- **Save Configuration...**
This command saves the port and video settings in a file with the extension .cfg (default).

In the **Windows Menu**, the commands for the control of the window creation are summed up.

With the function keys, the most important commands of the menu bar can be called:

- **F2:** Store
- **F3:** Load
- **F6:** Next Window
- **Shift + F6:** Close Previous Window
- **Alt + F3:** Close Window

Further information on the IGBT can be found in the corresponding manual, which is available through WEISS-ELECTRONIC on demand.

3.2 Operation with Hand Terminal HT2000 resp. PC-Terminal Program

The LED-Display of the **HT2000** has 4 lines with 16 characters each. After having entered CR, the main menu will be faded in. This HT-page has the following structure:

1st line: device type,	example:	IG745/3
2nd line: possible commands,	example:	B/C/E/F/G/H/M/O
3rd line: text line for command line:	command	K. value
4th line: command line,	example:	E 1 4

In the example, the **sE**nsitivity (code 'E') of the **1**st channel is set to level **4**. The classification of this value with the actual sensitivity $\Delta f/f_0$ in % can be found in the parameter table in the appendix (chapter 7.3).

Each command line has to be finished with CR. Subsequently, a balancing is carried out for the selected channel, if necessary. No RESET is required and all other channels will operate normally. The input of the values is made decimally. With settings that do not require any value input (see e.g. default setting), the input has to be finished with CR after the channel number input. If device-specific parameters (e.g. direction logic) shall be set, '0' has to be entered for the channel number. With the keys Backspace, ESC (PC-Keyboard) and DEL (HT2000), an input can be cancelled. With a wrong code and / or channel number as well as exceeding the value range, the whole command line will be ignored.

To carry out the default setting, the following inputs into the command line are necessary:

'V' - '0' - CR	default setting for device parameters
'V' - '1' - CR	default setting for channel 1
'V' - '2' - CR	default setting for channel 2
'V' - '3' - CR	default setting for channel 3
'V' - '4' - CR	default setting for channel 4

With the input

'C' - channel number - CR (channel number: '1' ... '4'),

the individual parameters and diagnosis values of the channel and the device are displayed in the command line after each following CR (classification code - parameters / diagnosis value see chapters 7.3, 7.4). After the last parameter or the input of Backspace, ESC resp. DEL, the device will return to the command line input mode.

4 Display and Service Elements

As display elements, 7 LED's can be found at the front panel of the IG745/3:

- **CH1** Switching Status-LED channel 1
- **CH2** Switching Status-LED channel 2
- **CH3** Switching Status-LED channel 3
- **CH4** Switching Status-LED channel 4
- **ERROR** Collective Error Message-LED
- **TRANS.** LED shows transfer process of the serial RS485-port
- **FUNC.** Function-LED, blinks with $f = 1 \text{ Hz}$ with normal function

The Channel-LED's CH1 ... CH4 show, besides the status of the switching output, the cause of error with a defined blinking frequency, a switching-on/-off delay or the first attenuated channel with direction logic (see also chapters 5.2, 6.1.5, 6.5.2).

Since all detector settings are carried out via the RS232-port, only a combined RESET-LED-switch exists as service element at the front panel. The switch contains three positions:

- upper position: RESET of the detector (key-switch function)
- middle position: LED's switched off
- lower position: LED's switched on.

To adapt the loop oscillator to smaller inductivities, one jumper per channel (at the loop transmitters) can be plugged in. The following inductivity ranges result with that:

- lower position (direction loop transmitter, default setting): 40 μH ... 2000 μH (complete)
80 μH ... 400 μH (advised)
- upper position (direction pc board edge): 20 μH ... 1000 μH (complete)
40 μH ... 200 μH (advised).

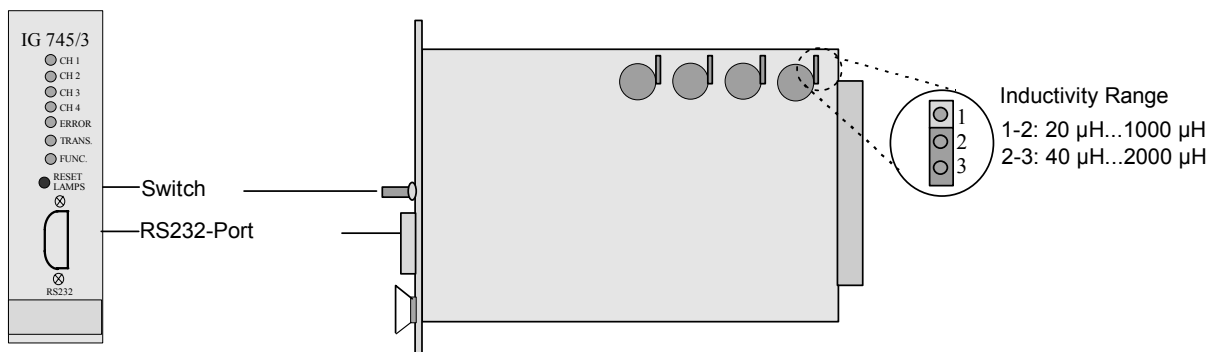


illustration 1: Display and Service Elements

5 Balancing and Error Diagnosis

5.1 Balancing

Balancing means the initialisation of a channel. With that, all settings are carried out according to the parameters saved in the EEPROM (e.g. frequency, sensitivity, measuring time). During the balancing, no permanent status changes of the loop may occur. During the balancing, no vehicle detections can happen on this channel, after the balancing, the channel at first will always be in an unattenuated status.



Warning



By the balancing of a channel, vehicles being in the sphere of activity of the induction loop at that time will be faded out. This means that they are not detected during and after the balancing!

IG745/3 carries out a balancing

- after the switching-on of the supply voltage
- by pressing the RESET-key
- by an external RESET-signal at the connector strip (0 V at external RESET, pin d28)
- by appearance of a device-internal RESET-status (e.g. Watchdog or Power-Fail)
- by a corresponding command of the IGBT- or Hand Terminal.

After a RESET, all channels are balanced, on demand via IGBT or Hand Terminal only the selected channels. All other channels operate without further influencing of their detection. The balancing period is approx. 1 s, with uninfluenced induction loop. During the balancing, the LED „FUNC.“ is switched on (no blinking) and the Channel-LED's „CH1“ ... „CH4“ show the balancing channel.

5.2 Error Detection and Error Removal

The IG745/3 can detect the following error states during the balancing:

- | | |
|---------------------------|---|
| • loop short-circuited: | blinking frequency of the Channel-LED 2 Hz |
| • loop open: | blinking frequency of the Channel-LED 1 Hz |
| • frequency not settable: | blinking frequency of the Channel-LED 0.5 Hz |
| • operation failure: | blinking frequency of the Channel-LED 0.25 Hz |

In the IGBT, these errors can be displayed in the channel windows as diagnosis parameters „Channel Errors“ or as error code with the hand terminal (see also chapter 7.4). Furthermore, the Collective Error Message-LED „ERROR“ and the corresponding opto-coupler output of the connector strip displays an error status at one channel at least. In addition, the open collector output of the faulty channels is set and the LED of the channel blinks with the above mentioned error-dependent frequency.

With short-circuited or open loop, the error can be detected and removed.

If the frequency cannot be set, the loop inductivity will be outside the advised range (see chapter 4). An improvement will be the setting of a different frequency range (chapter 6.1.2) or the modification of the loop oscillator jumpers J1 ... J4 (see chapter 4) with small inductivities.

The error message „Operation Failure“ shows the appearance of external interference effects during the balancing. This can be observed with longer balancing periods (approx. 3 s - 30 s per channel). The external interference effects have to be detected and removed, in order to guarantee a correct functioning of the detector. Otherwise, faulty detections can occur, i.e. the respective channel will switch without loop attenuation. The external interference effects can be caused by outside fields. The choice of a different frequency range can improve the situation. The channel can furthermore be cleared by switching on the Oversampling-Process (chapter 6.1.6).

If the outside fields are caused by other loop detectors of type IG745/3, this influencing can be removed by synchronization of the detectors via the synchronization lines of the connector strip (chapter 6.5.3).

6 Parameters and Functioning

Most of the parameters (except for Detector Flags) can be set in a channel-specific way. Besides the parameters settable by the user, the IG745/3 also gives diagnosis data, that can be represented in the IGBT. These values cannot be modified directly, but they result from the parameters (e.g. frequency from set frequency band), are gained during operation (e.g. last amplitude) or result from the operational status of the device (e.g. channel status, RESET-counter). It has to be taken into account that all displayed data represent the current status of the detector during the time of parameter polling (IGBT-menu point: „Poll Settings...“).

The parameter and diagnosis values can be found in the tables in the appendix section (chapters 7.3, 7.4). The parameter features given there correspond to the ones in the IGBT.



Warning



The user has to take care of the fact, that the set parameters have to guarantee a logical and safe functioning of the detector.

6.1 Definition of the Channel Parameters

6.1.1 Sensitivity / Measuring Time

The sensitivity defines the response threshold for the vehicle detection and it is defined as the frequency change Δf in relation to the balancing frequency f_0 . A high sensitivity causes a low switching threshold and therefore a high response sensitivity. The sensitivity should not be set higher than absolutely necessary, since otherwise, the detection could be disturbed during the appearance of external interference effects (e.g. power consumption lines in the loop area, loops of bad quality, coupling-in of other detectors).

Sensitivity and measuring time can mainly be set independently of each other with the IG745/3. A suitable combination can so be found practically for every field of operation (classification detector, door/gate detector, bicycle detector).

But the sensitivity is limited by the measuring time. So, the highest level of sensitivity can only be achieved with the longest measuring time. The limitation of the sensitivity with a given measuring time is automatically carried out by the IG745/3:

measuring time [ms]	/ level	maximum sensitivity $\Delta f/f_0$ [%]	/ level
2.5	/ '0'	0.1	/ '4'
5.0	/ '1'	0.06	/ '5'
7.5; 10.0	/ '2'; '3'	0.035	/ '6'
12.5; 15.0	/ '4'; '5'	0.02	/ '7'
20.0; 25.0; 30.0	/ '6'; '7'; '8'	0.012	/ '8'
35	/ '9'	0.007	/ '9'

Faulty or switched-off channels are automatically set to the shortest measuring time (2.5 ms). The actual measuring time remains saved in the EEPROM.

6.1.2 Frequency Range

The loop frequency of each channel can be set to one of four frequency ranges:

frequency level	frequency range in kHz
'0'	30 - 44
'1'	45 - 64
'2'	65 - 84
'3'	85 - 110

This can contribute to the disturbance elimination during the operation of several detectors coupled to one another via loops and / or loop feeders. With the frequency of external disturbing sources known, a disturbance elimination can also be achieved by choice of a suitable frequency range. If the selected frequency range cannot be set, the channel will so be reported as being disturbed (see also chapter 5.2).

6.1.3 Holding Time

The holding time is started with every detection. If the holding time is running without the channel being open, the channel will be reset. If a vehicle is still on the loop at that time, this vehicle will then be faded out. In case the vehicle leaves the loop afterwards, the further detection process depends on the set control (see chapter 6.1.7). The detection at first is more sensitive with the DTR (see chapter 6.1.7) and it then will slowly be levelled onto the original sensitivity. With the THZ (see chapter 6.1.7), the original sensitivity will be achieved approx. 4 s after leaving the loop, if no detections are made during that time. With static holding time (holding time infinite), external interference effects can lead to a shortening of the holding time. The setting of a finite holding time provides a safe operation in such cases. With longer holding times, the over-sampling should be switched on in any case (see chapter 6.1.6).

6.1.4 Channel Function

The channel function defines the reaction of the switching outputs (relay, open collector or opto-coupler) during detection. The channel can be switched off (output accordingly not busy, like loop) or it can be set to permanent busy-signal for the test of further switchings (e.g. traffic control systems).

When setting the presence signal, the switching output stays switched on for the time of the loop coverage. A selection of pulse signals can be made between pulse when the vehicle drives onto the loop or pulse when leaving the loop. The pulse period is approx. 100 ms without switching-off delay.

6.1.5 Switching-On / -Off Delay

The switching-on delay causes a delay of the switching signal (during presence and pulse) the length of the set time. If the loop gets free again during the switching-on delay, no busy-signal output occurs. So, the switching-on delay can also be used for the disturbance elimination of channels with faulty detection. It has to be checked for each single situation whether this measure will lead to a safe operation.

The switching-off delay prolongs the presence signal for the time set after the release of the loop. With the pulse signals, the switching-off delay serves to set the pulse period. The complete pulse period then results from the set time plus approx. 100 ms.

With the direction logic switched on, the switching-off delay serves to connect the first and second attenuated loop. A direction logic can so be realized for vehicles that cannot attenuate both loops at a time, too (e.g. bicycles).

The switching-on delay is displayed by the Channel-LED with a blinking frequency of 8 Hz, the switching-off delay with a blinking frequency of 16 Hz.

6.1.6 Oversampling

Several measurements (x2: 2 measurements, x4: 4 measurements) are united and a higher interference safety will so be achieved. The reaction time of the channel is doubled resp. quadrupled by activation of the oversampling:

channel reaction time = cycle time x channel oversampling factor
(cycle time see ch. 6.4.2, oversampling factor = 1, 2, 4)

With an unattenuated channel, this means, that the loop has to be attenuated longer, in order to detect the channel.

6.1.7 Channel Flags

Four settings can be made:

- contact position of the switching outputs
- reaction during disturbance
- temperature regulation
- switch on/off the classification function (see chapter 6.5.1)

The **contact position of the switching outputs** (relay resp. opto-coupler optional) can be influenced in the following way:

- operating current principle (ASP): contact closed with released relay and unattenuated loop
- closed-circuit current principle (RSP): contact open with pulled-in relay and unattenuated loop (default setting)

The **reaction during disturbance** can be set as follows:

- switching output of the channel busy on loop (default setting, abbr.: SB)
- switching output of the channel not busy on loop (default setting, abbr.: SNB)

The type of **temperature regulation** can also be set:

- permanent temperature regulation (abbreviation: DTR)
- holding time-related temperature regulation (abbreviation: THZ).

With the holding time-related temperature regulation, the set holding times (incl. static holding time) are kept without the appearance of external interference effects and the holding time is independent of attenuation. If external interference effects are expected, the permanent temperature regulation should be selected, with which smaller disturbances are regulated. But the set holding time will then be dependent on attenuation and it can therefore only be kept, if a sufficient attenuation exists.

6.2 Meaning of the Detector Parameters

The detector parameters are settings that concern several or all channels of the detector and that are transferred together with the channel data between IGBT and detector.

6.2.1 Detector Flags

Four settings can be carried out:

- switch on/off the direction logic channels 1 / 2
- switch on/off the direction logic channels 3 / 4
- synchronization: Master/Slave
- reaction of all channels during error removal

For the direction recognition, the channels 1 / 2 resp. 3 / 4 are united into one direction logic. The switching output of the channel occupied at last during the vehicle passing is activated. The selected channel function here determines the type of signal (presence or pulse signal).

If several detectors shall be synchronized with one another to avoid mutual influencing, the Master/Slave setting has to be carried out here.

If the detector recognizes a loop error (open or short-circuited loop), the reaction of the channels during error removal can be determined. With the Flag switched off, a balancing of the detector (RESET or channel balancing via IGBT) has to be carried out after the error removal. With the Flag switched on, the error removal will be detected automatically and a RESET will be carried out independently. It has to be taken care of the fact that vehicles being on the loop at that time have to be faded out!

Further information on the direction logic and the synchronization can be found in chapter 6.5.2, resp. chapter 6.5.3.

6.3 Meaning of the Channel Diagnosis Values

These values are formed per channel by the detector during the operation and they can be represented in the IGBT. The displayed values have to be updated in the IGBT by parameter polling.

6.3.1 Channel Status

The channel status contains the following information:

- | | |
|-------------------------------------|---|
| • channel busy: | loop free or attenuated |
| • channel disturbed: | channel error-free or disturbed |
| • channel was disturbed (since POR) | channel is error-free, but it was disturbed before; this bit will be reset with the next Power On Reset (abbreviation: POR, i.e. reset when switching on the supply voltage) |

The displayed states are only valid for the time of the parameter polling!

6.3.2 Error Code

The error code informs on the type of error with a disturbed channel. The error causes mentioned in ch. 5.2 are given.

6.3.3 Number of Balancings

This option informs on the balancing processes having occurred since the last POR. This can include parameter modification, balancing processes triggered by RRESET-conditions or by error states in the loop operation. This information can therefore contribute to the faulty detection, since unreliably operating loops and/or detectors can be observed here.

6.3.4 Frequency

The frequency in kHz given here is inside the set frequency range. The frequency option is important with detectors coupled to one another, because a different frequency band has to be selected for each detector. The necessary minimum frequency range of approx. 10 kHz - 15 kHz then normally results automatically. A maximum of 4 detectors can so be set to different frequency ranges.

6.3.5 Switching Threshold

The switching threshold results from the set measuring time and sensitivity. The counting value of the internal counter circuit is given, with which a busy- resp. free-message is carried out. The switching threshold is proportional to the measuring time and the sensitivity. A doubling of the measuring time with half of the sensitivity value e.g. leads to a constant switching threshold.

6.3.6 Classification Switching Threshold

The classification switching threshold is a second threshold above the switching threshold with which the classification output channel 3 resp. 4 will be set for the channel 3 resp. 4 (see also chapter 6.5.1).

6.3.7 Maximum Attenuation

This value gives the maximum attenuation since the last balancing as counting value of the internal counter circuit. By comparison with the switching threshold, it can be found out whether the set sensitivity is enough. The following formula applies to each according case:

$$\text{maximum attenuation} > 10 \dots 100 \times \text{switching threshold}$$

6.3.8 Last Amplitude

The last amplitude gives the maximum value of the last loop attenuation. If this value exceeds the value of the maximum attenuation, the following will apply:

$$\text{maximum attenuation} = \text{last amplitude}$$

6.4 Meaning of the Detector Diagnosis Values

6.4.1 Error Code, Reset Counter

The error code presents the reason for the reset in a bit-coded way, the reset counter gives the number of resets since the last POR. These values can be reset with the IGBT-menu point „Reset Error Codes“ or with the hand terminal.

6.4.2 Cycle Time

The cycle time results from the aggregate of the measuring times of all channels (chapter 6.1.1):

$$\text{cycle time} = \text{measuring time channel 1} + \text{measuring time channel 2} + \text{measuring time channel 3} \\ + \text{measuring time channel 4}$$

With the help of the cycle time, the reaction time of the individual channels can be detected (see chapter 6.1.6).

6.5 Description of the Special Functions

6.5.1 Classification Function

The classification function serves to distinguish vehicle types with the attenuation amplitudes at single loops caused by vehicles (only channels 1 and 2, channels 3 and 4 switched off!). In addition to that, a second threshold above the switching threshold (classification switching threshold) will be defined. When exceeding the switching threshold, the output switches from channel 1 resp. 2; when exceeding the classification switching threshold, channel 3 resp. 4 switches additionally. When remaining under the switching threshold, channels 1 and 3 resp. 2 and 4 will be switched off. The channels 3 and 4 can so only be activated once per vehicle crossing. In the directory IGB of the IGBT-installation, example data for the classification function have been stored (KLASS*.IGB, command „Load ...“ chapter 3.1). These also take care of the necessary precision of the amplitude detection by choice of a short measuring time and of a low oversampling rate.

When using a special loop (approx. 10 m x 2.5 m), a bus classification can be realized, because busses cause a higher attenuation on this loop in moving traffic than a car convoy (exception:: traffic jam area!).

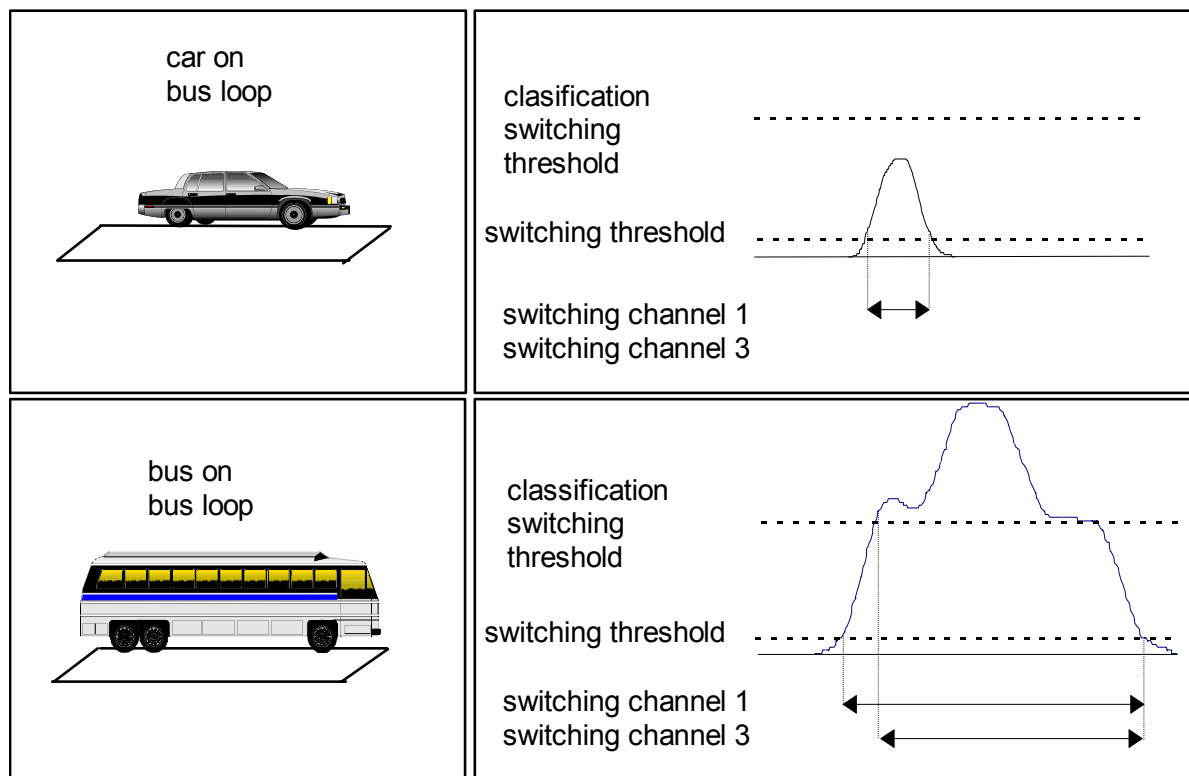


illustration 2: Bus Classification with Special Loop

When using standard loops (length 1 m - 2.5 m), this function can also be used for a simple car-lorry differentiation. Highly attenuated vehicle types (e.g. busses) are classified as cars with that and less attenuated vehicles (e.g. truck trailers, motorcycles) are classified as lorries.

The classification function is activated by setting the corresponding Channel Flag (see chapter 6.1.7). The classification switching threshold here is set to a default value at first (15x the switching threshold).

To detect the desired classification switching threshold, 5 vehicles of the vehicle type to be classified are subsequently needed (e.g. bus with bus classification or car with car/lorry classification).

With the command

'K' - '1' - '1' - CR for channel 1 resp. **'K' - '2' - '1' - CR** for channel 2,

the detection of the classification switching threshold is activated for the next car crossing via the terminal window of the IGBT or the HT, i.e. the maximum detuning (amplitude) is detected for this vehicle. The detection of the amplitude is displayed in the terminal window with the output

```

„K1: 4 Kfz left“      resp.  „K2: 4 Kfz left“
      .
      .
„K1: 1 Kfz left“      resp.  „K2: 1 Kfz left“.
```

With the input of CR, a new HT-page is created and a new command line can be entered.
With the command

```
‘K’ - ‘1’ - ‘0’ - CR for channel 1  resp.  ‘K’ - ‘2’ - ‘0’ - CR for channel 2
```

before the counting car crossing, the activation can be removed. An intermediate RESET or a balancing of the channel again resets the detection of the classification switching threshold into the starting position (5 vehicles, classification switching threshold = 15x switching threshold).

After 5 vehicles have been evaluated in that way, the classification switching threshold will be saved as average of the 5 amplitudes minus approx. 25%. The detection of the threshold will be displayed in the terminal window of the IGBT with the output

```
„K1:threshold det.“  resp.  „K2:threshold det.“.
```

The classification switching threshold can be checked in the diagnosis channel window. With that, the relation of the values „Switching Threshold“, „Max. Ampl. Since Balancing“ and „Last Amplitude“ should also be checked.

The classification switching threshold only influences the switching-on of the outputs of channel 3 resp. 4, channel 1 resp. 2 stay uninfluenced by that. As channel function for channels 1 and 2, only the presence signal is allowed, **switching-on and -off delay are not allowed**. The quality of the classification will exclusively be influenced by the classification switching threshold. Its detection e.g. includes taking care of the fact that the vehicles should not cross the loop diagonally.

To restart the described initialisation process, the classification function has to be switched off and on again. After detection of the classification switching threshold, the settings for frequency, measuring time and over-sampling may not be modified any more, since other amplitudes result from that and the detected classification switching threshold will not be valid any more.

6.5.2 Direction Logic

The direction logic serves to a travel direction detection of vehicles. 2 successive loops are combined to one loop system with that (channel 1 and 2 resp. channel 3 and 4). For the direction logic, the switching output of the loop crossed at last is activated with a coverage of both loops at the same time. The channel function here determines if the signal is a presence or a pulse signal.

To realize a direction logic for vehicles that cannot occupy both loops at the same time (e.g. bicycles), the switching-off delay can be used for the artificial prolongation of the busy-signal of the loop covered at first. The function of the switching channel is not influenced by the switching-off delay.

The loop covered at first is displayed by the blinking (frequency 4 Hz) of the accompanying Channel-LED.

The blinking of the direction logic dominates the switching-off delay. **A switching-on delay is not allowed with the direction logic.**

The direction logic is a device parameter and it is separately displayed in the corresponding parameter window of the IGBT for channels 1 / 2 and 3 / 4. It is activated with the command „Transfer to the Detector...“ and selection of at least one channel (device parameters are transferred together with the channel parameters). During a loop disturbance at one of the loops of the direction logic, the other loop will be reported as being faulty too (error „Operation Failure“).

The following illustrations show the function of the direction logic with a single vehicle and in convoy traffic for the travel direction from loop 1 to loop 2. For the opposite travel direction and the channels 3 and 4, the function is accordingly.

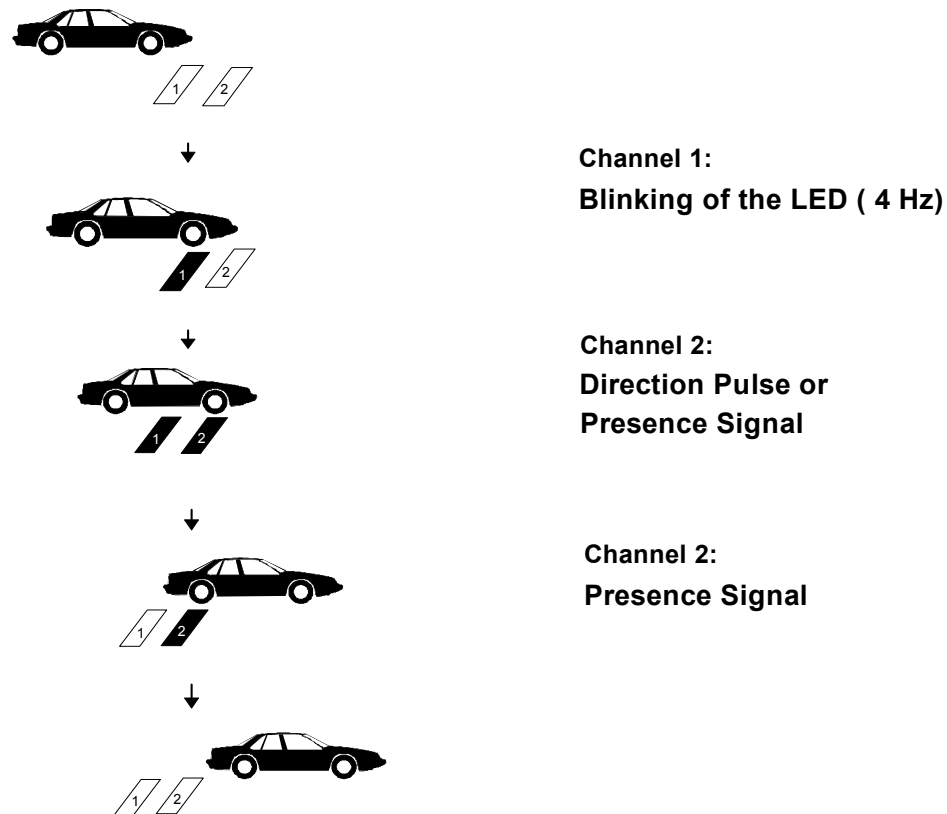


illustration 3: Direction Logic with Single Vehicle

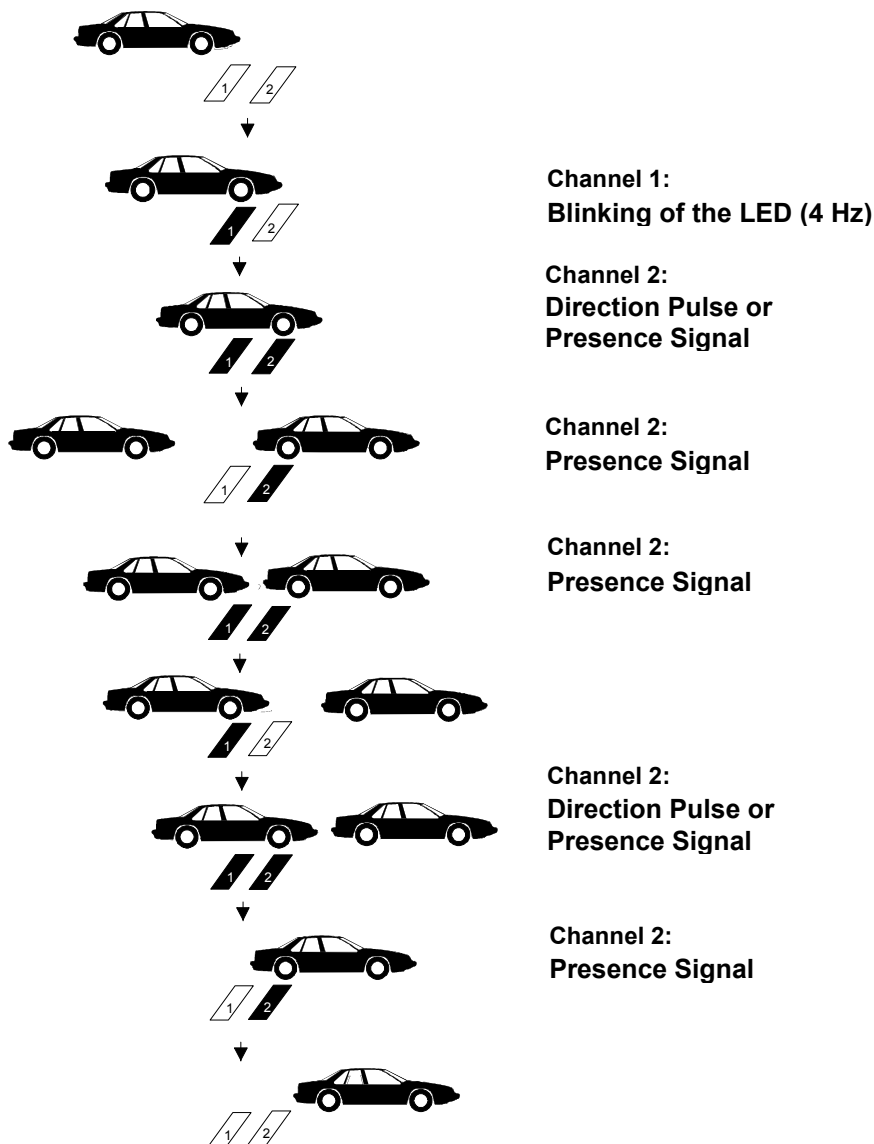


illustration 4: Direction Logic with Convoy Traffic

6.5.3 Synchronization

The synchronization function can be used to eliminate interferences either at several detectors coupled via loop feeders or at detectors directly coupled by loops, if the setting of different frequency ranges (see chapter 6.1.2) does not cause a release on its own. The synchronization function causes a measurement of the same respective channel at the same time and at all connected devices. The set measuring times are considered automatically, i.e. the longest measuring time of the respective channel group determines the complete measuring time of this channel. With systems coupled with one another in an especially strong way, different frequency ranges have to be set.

With the installation, the synchronization lines at the connector strips (b6 and b26 each) of all detectors (a maximum of 30 devices) have to be interlinked at first. In addition, one detector has to be defined as MASTER. The MASTER/SLAVE-function is a device parameter and it is displayed in the corresponding window of the IGBT. With the command „Transfer to the Detector...“ and selection of any channel, the setting will be transferred (device parameters are transferred together with the channel parameters). A RESET is carried out when switching the MASTER/SLAVE-setting. All other devices can remain in the standard setting SLAVE. After the definition of the MASTER-device, a RESET has to be carried out at all SLAVE-devices! After the detectors have been balanced, all „FUNC.“-LED's will blink synchronously, but the ones of the MASTER will blink in an inverted way. A total RESET can be triggered by a RESET of the MASTER.

7 Appendix

7.1 Technical Data

connector strip:	male multipoint connector DIN41612, type F, 48-pin, 3 rows d / b / z, contact b32 leading (PE); optional: type C, 48-pin, 3 rows a / b / c, type C, 32-pin, 2 rows a / c, connection see chapter 7.2		
supply voltage:	24 V AC / DC, permissible DC-voltage range: permissible AC-voltage range: optional:	14 V DC ... 38 V DC 12 V AC _{eff} ... 26 V AC _{eff} , 50 / 60 Hz 5 V DC +/- 5% or 12 V DC +/-10%	
power consumption:	maximum 60 mA / 1.4 W with 24 V DC		
surrounding temperature:	according to DIN VDE 0832 -25°C - + 80°C		
storage temperature:	-40°C - + 80°C		
loop inductivity: (including feeder!)	max. 20 µH - 2000 µH (see also chapter 4)		
serial ports:	RS232-Service Port 4800 baud, 1 start, 8 data, 1 stop bit, no parity; 9-pin DSUB-plug at front panel; connection see chapter 7.2.2 RS485-Data Port, customer-specifically parameterizable		
relay outputs:	2 potential-free switches per channel for busy- and pulse-signals, relay contacts with RC-part interference-free		
opto-coupler outputs:	1 potential-free switch per channel for busy- and pulse-signals (alternative to relay type) and 1 collective error message		
Solid-State relay outputs:	1 potential-free switch per channel for busy- and pulse-signals (alternative to relay type)		
open collector outputs:	1 non-potential-free contact per channel for busy- and pulse-signals, 1 non-potential-free contact per channel for error message		

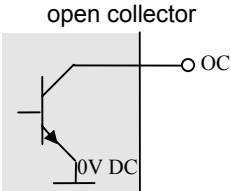
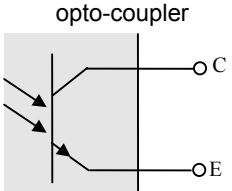
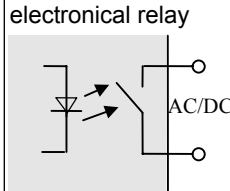
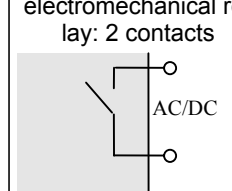
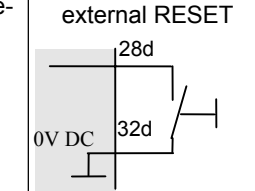
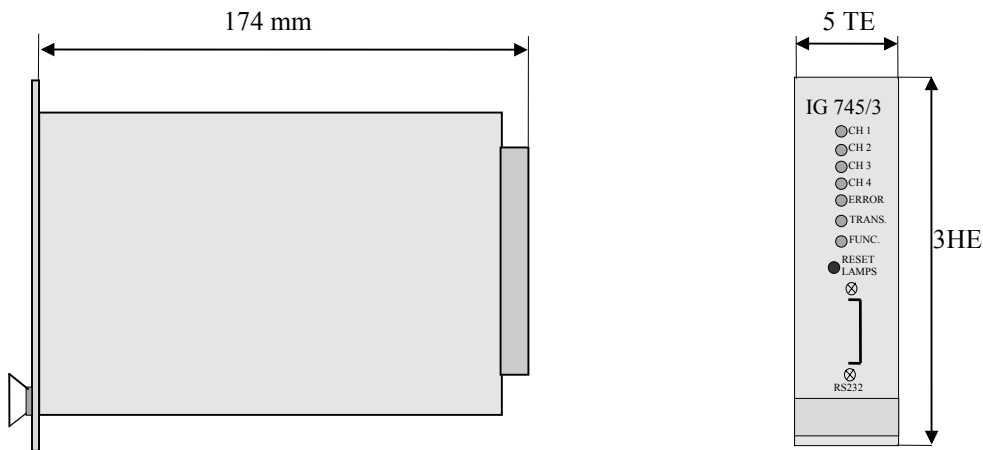
				
• open collector	• opto-coupler	• electronic relay	• electro-mechanical re- lay	
$U_{\max} = 50 \text{ V}$	$U_{\max} = 50 \text{ V}$	$U_{\max} = 40 \text{ V AC / DC}$	$0.3 \text{ A / } 125 \text{ V AC}$	
$I_{\max} = 300 \text{ mA}$	$I_{\max} = 50 \text{ mA}$	$I_{\max} = 0.2 \text{ A Peak AC/DC}$	$0.3 \text{ A / } 110 \text{ V DC}$	
$P_{\text{tot}} = 250 \text{ mW}$	$P_{\text{tot}} = 100 \text{ mW}$	$P_{\text{tot}} = 100 \text{ mW}$	$1 \text{ A / } 30 \text{ V DC}$	
$I_c \leq 20 \text{ mA}; U_{\text{CEsat}} \leq 0.4 \text{ V}$	$I_c \leq 10 \text{ mA}; U_{\text{CEsat}} \leq 0.4 \text{ V}$			
not potential-free	potential-free	potential-free	potential-free	

illustration 5: Technical Data of the Outputs

permissible voltage range of the other inputs/outputs:	RS485A (b2), RS485B (b4), synchronization (b6, b26), ext. reset (d28/c28): 0 - 5 V DC (reference point: 0 V DC (d32/c32))
overvoltage protection:	loop inputs: transmitter, Z-diode, glow lamps supply voltage: suppressor diode
pulse period:	approx. 100 ms with pulse- and direction-signals
cycle time / reaction time:	10 ms ... 140 ms / 10 ms ... 560 ms, dependent on set measuring time and oversampling
speed limit for vehicle detection:	with measuring time 2.5 ms and oversampling x1: < 200 km/h with measuring time 5.0 ms and oversampling x1: < 100 km/h with measuring time 12.5 ms and oversampling x1: < 50 km/h with measuring time 12.5 ms and oversampling x2: < 25 km/h
measures:	19"-rack pc board (100 mm x 160 mm), rack width: 5 TE, optional 4TE, height: 3 HE
weight:	200 g



Measures are subject to manufacturers' tolerances.

illustration 6: measures

7.2 Pin Connections

7.2.1 Connector Strip

48-pin male multipoint connector, DIN 41612, type F, connection rows d / b / z

32-/48-pin male multipoint connector, DIN 41612, type C, connection rows a / b* / c

	d b z	d (c)	b *	z (a)
2		loop 2	RS485A	loop 1
4		loop 4	RS485B	loop 3
6		loop 2	synchr. line 1	loop 1
8		loop 4	CH1 switching output (B)	loop 3
10		CH2 switching output (A) (E)	CH2 switching output (B)	CH1 switching output (A) (E)
12		CH4 switching output (A) (E)	CH3 switching output (B)	CH3 switching output (A) (E)
14		CH2 switching output (A) (C)	CH4 switching output (B)	CH1 switching output (A) (C)
16		CH4 switching output (A) (C)	CH1 switching output (B)	CH3 switching output (A) (C)
18		CH2 ext. error message (OC)	CH2 switching output(B)	CH1 Störmeldung ext. (OC)
20		CH4 ext. error message (OC)	CH3 switching output (B)	CH3 Störmeldung ext. (OC)
22		24 V AC/DC	24 V AC/DC	24 V AC/DC
24		CH4 switching output (OC)	CH4 switching output (B)	CH3 switching output (OC)
26		CH1 switching output (OC)	synchr. line 2	CH2 switching output (OC)
28		external RESET (low-active)	collective error message (E)	collective error message (C)
30		24 V AC/DC	24 V AC/DC	24 V AC/DC
32		0 V DC	PE	+24 V DC / +12 V DC / +5 V DC

(E): emitter with opto-coupler type
(C): collector with opto-coupler type

(A), (B): A-/B-contact with relay type
(OC): open collector

* not used with type C, 32-pin

illustration 7: pin connection

7.2.2 RS232-Port Connection Cable

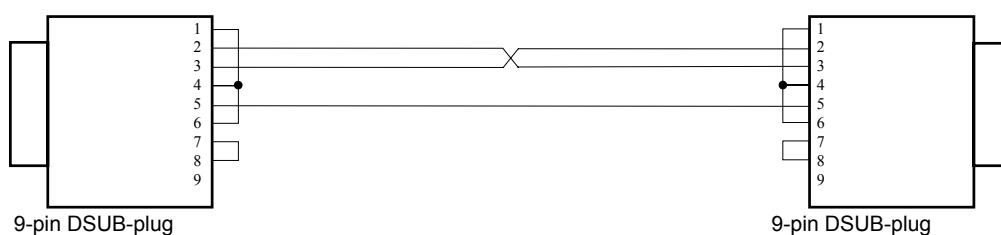


illustration 8: Serial Connection IG745/3 - PC

7.3 Parameter Table / Default Setting

This table shows all settable parameters of the IG745/3. It is especially useful for the operation with the HT2000. The parameter codes to be entered in the command line, the value range of the channel input, as well as the permissible values of the parameters and their meaning are given. The default setting of the IG745/3 is highlighted in bold / cursive.

parameters	error code for input with HT2000 / possible channel input	values to be entered with operation via HT2000, meaning	parameters	command code for input with HT2000 / possible channel input	values to be entered with operation via HT2000, meaning
sensitivity $\Delta f/f_0$	'E' / '1' ... '4'	'0': reserved '1': 0.5% '2': 0.3% '3': 0.17% '4': 0.10% '5': 0.06% '6': 0.035% '7': 0.02% '8': 0.012% '9': 0.007%	switching-on delay, switching-off delay	'D', 'N' / '1' ... '4'	'0': none '1': 0.2 s '2': 0.5 s '3': 1.0 s '4': 1.5 s '5': 2.0 s '6': 5 s '7': 10 s '8': 20 s '9': 30 s
frequency range	'F' / '1' ... '4'	'0': 30 - 44 kHz '1': 45 - 64 kHz '2': 65 - 84 kHz '3': 85 - 110 kHz	oversampling	'G' / '1' ... '4'	'0': x1, switched-off '1': x2 '2': x4
holding time	'H' / '1' ... '4'	'0': infinite '1': 2 s '2': 10 s '3': 30 s '4': 1 min '5': 5 min '6': 30 min '7': 1 h '8': 2 h '9': 12 h	Channel-Flags	'Q' / '1' ... '4'	bit-coded, Bit 0: reserved Bit 1: contact position of the relay 0: closed-circuit principle (RSP) 1: operating current principle (ASP) Bit 2: reaction during failure 0: loop not covered 1: loop covered Bit 3: temperature regulation 0: permanent temperature regulation (DTR) 1: holding time-related temperature regulation (THZ) Bit 4: classification function 0: off , 1: on Bits 5, 6, 7: free
channel function	'O' / '1' ... '4'	'0': channel off '1': presence signal '2': pulse signal during entrance '3': pulse signal during exit '4' - '8': reserved '9': permanent signal	Detector-Flags	'Y' / '0'	bit-coded, Bit 0: direction logic channels 1-2 0: off , 1: on Bit 1: direction logic channels 3-4 0: off , 1: on Bit 2: MASTER / SLAVE 0: SLAVE , 1: MASTER Bit 3: reserved Bit 4: balancing after error 0: no automatic balancing after error removal 1: automatic balancing after error removal Bit 5: free Bits 6, 7: reserved
measuring time	'M' / '1' ... '4'	'0': 2.5 ms '1': 5.0 ms '2': 7.5 ms '3': 10.0 ms '4': 12.5 ms '5': 15.0 ms '6': 20.0 ms '7': 25.0 ms '8': 30.0 ms '9': 35.0 ms			

7.4 Diagnosis Values Table

This table shows all diagnosis values of the IG745/3. They are not directly settable, but they result from the parameter settings (e.g. frequency value from set frequency range) or they show the current status of the device (e.g. channel status, balancing errors, reset counter). The table is especially suitable with the output of these values via the HT2000 (input: 'C' - channel number - CR, see also chapter 3.2). The codes and the value range represented in the command line are also given.

diagnosis value	code	value range / unit	diagnosis value	code	value range / meaning
balancing counter (since POR)	'z'	0 - 0xFFFF (65535)	channel status	'U'	bit-coded, 0 - 0xFF Bit 0: channel busy
frequency	'f'	0 - 0xFF (255) / kHz			Bit 1: channel is disturbed
classification switching threshold	'n'	0 - 0x7FFF (32767)			Bit 2: channel was disturbed (since POR) Bits 3 - 7: free
switching threshold	'o'	0 - 0x7FFF (32767)	channel error	'{'	bit-coded, 0 - 0xFFFF Bit 0: loop short-circuit
maximum amplitude since balancing	'l'	0 - 0x7FFF (32767)			Bit 1: loop open
last amplitude	'p'	0 - 0x7FFF (32767)			Bit 2: frequency not settable Bit 3: operation failure Bits 4 - 15: free
resetcounter (without POR)	'j'	0 - 0xFFFF (65535)	resets (without POR)	'~'	bit-coded, 0 - 0xFFFF Bit 0: reserved
cycle time	'u'	0 - 0xFFFF (65535) / ms			Bit 1: RESET from port Bit 2: RESET after EEPROM-error Bit 3: reserved
					Bit 4: reserved Bit 5: RESET after parameter change Bit 6: POWER-FAIL-status Bit 7: Watchdog-RESET Bit 8: RESET Parameter-Check-Error Bit 9: reserved Bit 10: switch- or external RESET Bits 11 - 15: free

7.5 IGBT-Abbreviations

parameters	abbreviation of the IGBT	meaning
Channel-Flag	contact: RSP/ASP	contact position of the relays/opto-couplers: „Closed-Circuit Principle“ / „Operating Current Principle“
Channel-Flag	regulation: DTR/THZ	permanant temperature regulation / temperature regulation in compliance with the holding time
Channel-Flag	during fail.: SNB/SB	reaction of the switching outputs during failure: same as loop not covered / loop covered
Channel-Flag	class.fct.	classification function
Detector-Flag	dir.log. K1/K2 resp. K3/K4	direction logic channel 1/channel 2 resp. channel 3/channel 4
Detector-Flag	bal.after fail.	balancing after failure elimination, i.e. automatic balancing after error removal yes/no

