



Radar detector

FALCON LC

Handleiding

PRODUCT: FALCON LC
DATUM: Februari 2026
VERSIE: Versie 1.0



Versie	Datum	Omschrijving	Door
0.1	02-2026	Eerste uitgave	JvdB

digital *FALCON LC/LCL II*

- *The compact microwave detector* -

*User manual*¹



Revision: 12 October 2017

¹ Subject to technical change

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1 Function principle

The digital Falcon LC II is a radar sensor for the measurement of object movement speeds, switching an output relay if a programmed speed threshold is exceeded.

Physically the digital Falcon LC II measures according to the Doppler principle. The sensor emits radio waves at 24.165 GHz. An object moving towards or away from the sensor, causes a reduction or increase of the frequency of the radio wave reflected by the object. By superposition of send and received radio wave (mixing) a low frequency signal is produced, with a frequency proportional to the object speed.

The detector has two receivers which positions differ by a quarter wave length. The resulting +/- 90° phase shift, depending on the movement direction is used to determine the movement direction of the object as well as to filter out distortion signals with illegal phase shifts. The received signals are evaluated and compared with the programmed speed threshold and the set movement direction.

The high frequency transceiver of the detector is an encapsulated planar module, producing radio waves by a PHEMT-oscillator. The encapsulation excludes the damage of the module through electrostatic discharges as possible with usual wave guide gun diode transceivers with low barrier Schottky mixer diodes. The efficiency of the PHEMT-oscillator to change electrical in radio wave energy is 4-5 times higher as with gun diode oscillators. The result is a comparable very low power consumption of the whole detector of typical 0.75 Watt. The low heat production means, low component stress, low aging, high MTBF and finally a long lifetime of the detector compared to gun transceiver detectors.

2 Antenna characteristic

The digital Falcon LC II is delivered with a planar encapsulated HF-transceiver, which surface is covered with two patch antenna fields, one for emission (transmission) of the radio wave and one for the reception of the reflected signal.

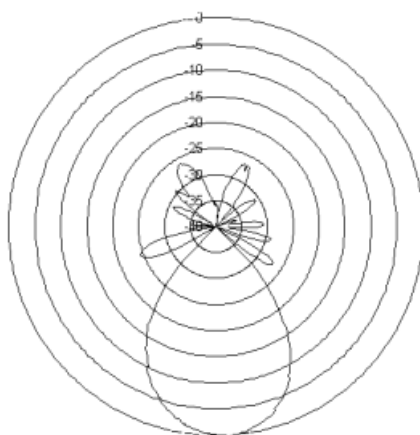


Diagram 1: Antenna diagram Falcon LC II

The polar diagram beside shows the figure of the standardized transmission power, related to 100 % of transmitted power in the 0° angle for the patch antennas.

The usually for antennas rated beam width angle, is for this antennas 28° vertical x 28° horizontal. This the angle where the standardized transmitted power is reduced for 3 dB, what means to the half.

This antenna angle is only a measure for the focusation of the beam, it does not mean that an object is detected at this angle.

The detection angle for short distances (< 10 meter) is approximately the double angle 28° to each side.

An antenna angle of 28° is sufficient to cover 3 lanes if the detector is mounted overhead in 6 m height, with a mounting angle of 60°.

A lane selective detection is not possible with this wide antenna characteristic.

The covered cross section with the numbers of the former example would be:

$$2 \times \text{distance} \times \tan(\text{detection angle}) = 2 \times (6\text{m} / \sin(60^\circ)) \times \tan(28^\circ) = 8 \text{ m}$$

3 Detector installation

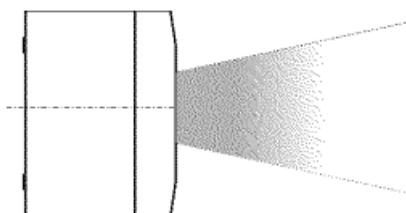


Illustration 1: Radio wave emission through the cover

The radar wave propagation of the beam in the K-band frequency range is similar to the propagation of optical waves.

Moved objects visible from the mounting spot are detected by the digital Falcon LC II if they are in its distance range.

The detector emits the beam orthogonal through the cover surface of the housing.

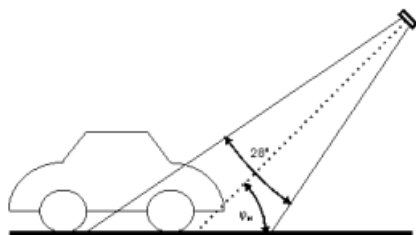


Illustration 3: Detector mounted overhead

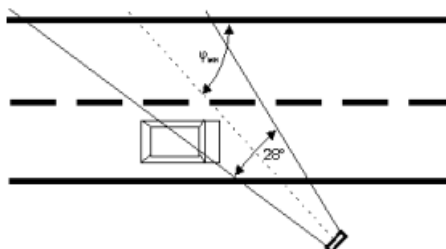


Illustration 2: Detector mounted lateral

The detector can be mounted overhead, see Illustration 3, or in lateral (side fire) position, see Illustration 2.

There are two main groups of applications, speed tracking and counting. In speed tracking applications the detectors is directed straight forward for long distance ranges (100 m) e.g. for speed triggered warning signs, green time interval elongation or switch to red if over speeding in front of traffic lights.

In counting applications the detectors is directed e.g. 45° or more to the road, so the radar shadow behind each vehicle is short and the detector loses the reflected signal after each passing vehicle. To this group of applications working with the detector on short distance (< 10 meter) belongs also the announcement of vehicles at intersections.

4 Function control

The function of the digital Falcon LC II is visible by the light wave guide head glued in the housing cover, illuminated by a red high brightness Led if a vehicle is detected. After power on the Led is also lit for 0.4 seconds.

5 Distance range

The distance range of the Falcon LC II in the free field is in average 100 meter for passenger cars. The Falcon LCL II has the double distance range of 200 meter.

The distance range can be reduced by the "Amplification" parameter setting, see chapters 9.3 and 12.3.

A minimum distance range for small mounting angles under unfortunate weather conditions, see below, of 70 meter should be reached by the Falcon LC II. Due to production tolerances the distance range may vary up to plus 50%.

A reduction of the distance range will happen:

- if objects in the radar beam hamper the free sight of the detector on the moving vehicle target, like trees, container, parking vehicles and so on.
- if the beam reaches vehicles in the not selected movement direction. The signals reflected by these "false" moving objects are recognised but not processed. In such cases turn the detector away from the unwished traffic lane till you get an optimal distance range again.
- through bad weather conditions. Snowfall, rain, fog or hail cause distance range reductions between 10% and 30% usually.
- if a strong distorting radio wave transmitter is near like other radars, mobile phone antennas, also high voltage cables and neon lights emit high frequency.

In general the distance range is highly dependent on the effective size of the reflecting surface. Therefore it is for trucks for 50 ... 100% higher and for motorbikes 50% lower than for ordinary passenger cars.

6 Measurement angle

Doppler-radar detectors measure the speed vector of a moved object parallel to the radar beam axis. This means that for mounting (measurement) angles larger than the detection angle of the sensor a too low speed value will be evaluated. In consequence the relay will not be switched.

Measurement angles till 28° for the Falcon LC II will not reduce the measured speed.

For applications with larger measurement angles, e.g. counting with an 45° mounting angle, where at the same time the relay shall be switched at a certain speed threshold, the Falcon LC II can be used if a speed threshold correction is considered.

The real speed threshold at which the relay is switched if measuring under mounting angles above 28° for a certain programmed speed threshold can be calculated

$$v_{\text{eff}} = v_{\text{Tab}} / \cos(\varphi_M - 28^\circ) \quad \text{with} \quad v_{\text{eff}} - \text{real speed threshold}$$

$$v_{\text{Tab}} - \text{programmed speed threshold}$$

$$\varphi_M - \text{Measurement angle}$$

Example: Measurement angle $\varphi_M = 45^\circ$; programmed speed threshold $v_{\text{Tab}} = 50 \text{ km/h}$

$$v_{\text{eff}} = 50 \text{ km/h} / \cos(45^\circ - 28^\circ) = 52,3 \text{ km/h}$$

7 Measurement error

	Measurement angle < 28°	28° < Measurement angle < 60°
Maximal error of the speed threshold	± 3 km/h @ v < 100 km/h ± 3 % @ v > 100 km/h	± 5 km/h @ v < 100 km/h ± 5 % @ v > 100 km/h with angular correction

8 Serial RS232 - Interface

8.1 Cable connection scheme for terminals and PCs

For the connection of the Falcon LC II to a PC or a terminal make a cable with a 9 pole female DSUB connector at the PC side. Connect it to the Falcon LC II terminal as shown in the table:

9 pole DSUB connector		Falcon LC II connector terminal	
Signal	PIN	Signal	PIN
RxD	2	TxD	4
TxD	3	RxD	3
GND	5	GND	1

This is a so-called null modem connection with crossed RxD and TxD wire.

Beside the 3 wires no further lines shall be connected, because the Falcon LC II does not support a hardware handshake.

The critical (maximum) length of a RS232/V24 data transmission cable can be estimated with the formula: cable length = $10^6 / \text{baud rate} = 10^6 / 9600 \approx 100$ meter

8.2 Data transmission and software

The data transmission is a pure text transmission with printable ASCII - characters. For the reception, to display and insert characters on your PC or Laptop you may use a so-called terminal software. A specific data transmission program is not needed.

You may use the "Hyper Terminal" program from Microsoft Windows, which part of all Windows operating systems since Windows 95/NT till Windows XP. Under Windows 3.1 or Windows 3.11 for workgroups exists the program "Terminal". For DOS countless terminal programs like "Norton Terminal", "Telix", "XCOM" and so on, are available.

8.3 Data transmission with the "Hyper Terminal"

To find the "Hyper Terminal" in the task bar, click on the start button in the task bar and then *Programs - Accessories - (Communication) - Hyper Terminal*.



Illustration 4

Start the program with a mouse click.

If you use the program the very first time a message prompt appears with the question if you want to define a modem connection. Quit with the "No" button.

Insert in the dialogue "Connection description" a name for the session and chose an icon, see also Illustration 4. Confirm with the "OK" button.

In the next window you have to define the interface to which the connection shall be done.

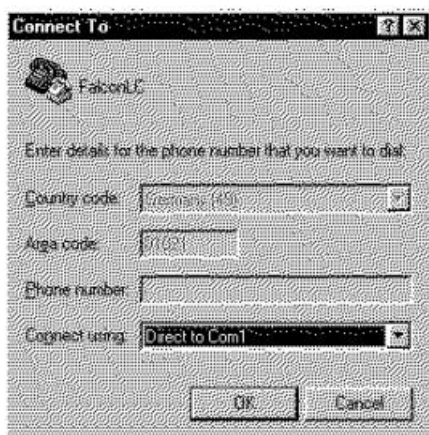


Illustration 5

Select a defined port designation in the selection field "Connect using", e.g. COM1 or COM2. The other input fields are shaded grey in consequence, because they are not needed for direct port connection, this fields are only used with modems, see Illustration 5.

Finally you have to insert or chose the data transmission parameters, use the values shown in Illustration 6.

After this is done and the "COM properties" dialogue is ended with the "OK" button the empty terminal screen appears.

Connect the Falcon LC II with the prepared cable to the serial COM port of your PC and supply the Falcon LC II with power.

The start message of the Falcon LC II appears in the terminal window:

```
!digital Falcon LC II Version 1.02
!Copyright by Via Traffic Controlling 2003
!Press <ESC> <?> for help
```

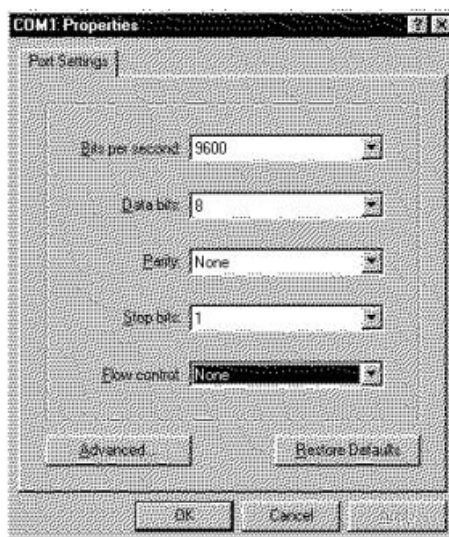


Illustration 6

9 Falcon LC II menu and parameter set

If you press the keys <ESC> and <?> in the Hyper Terminal the Falcon LC II sends a list of available parameters, their actual setting and other information:

```
!Parameters:
!<T> Speed threshold in km/h: 0
!<D> Detected direction: oncoming
!<A> Amplification: 16
!<O> Detected object: vehicle
!<H> Relay hold time in ms: 1000
!<F> Relay fail safe: off
!<N> Detector network address: 1
!<S> Special functions

!Information:
!Interface: RS232
!<C> Counted detections: 0
```

The list above shows the default parameter set ex factory, stored in the detectors non-volatile EEPROM memory. The item information reports the installed interface type and the number of

already counted detections, see also chapter "detection counter". During parameter insertion the vehicle detection is stopped.

9.1 Speed threshold¹

If a vehicles speed in the radar beam exceeds the set speed threshold the output relay is switched.

If you press first the <ESC> key and insert then <T> at your keyboard, the detector stops the speed measurement with the message „!Event detection stop“ and sends then the input prompt for the speed threshold:

```
!Event detection stop  
!Speed threshold=
```

Insert a whole number in the range 0 till 255 km/h and press the <Enter> key. If the number is a valid value the detector starts the speed measurement with the „!Event detection start“ message again. If the insertion is illegal the prompt „Speed threshold=„ is repeated until you insert a valid number.

9.2 Detected direction

The digital Falcon LC II measures vehicles moving in one direction (unidirectional) towards or away from the detector, or else moving in both directions (bi-directional) toward and away from the detector.

The detected direction is set after the insertion <ESC> followed by <D> with the following selection menu:

```
!Event detection stop  
!Detected direction:  
!<1> for oncoming  
!<2> for leaving  
!<3> for bidirectional  
!Select:
```

Press the <1> key for oncoming vehicles, the <2> for leaving or <3> for the detection of both movement directions.

9.3 Amplification

The gain of the analogue amplifiers of the signal receivers can be reduced in 16 stages. A reduction of the amplifier gain means a reduction of the Falcon LC II detection range.

Pressing the <Escape> key followed by the <A> character will force the Falcon LC II to send the input prompt for the „Amplification“:

```
!Event detection stop  
!Amplification (1 ... 16)=8  
!Event detection run
```

Enter the wanted amplification level number ended by <return>.

The „Amplification“ level set ex factory is 16, representing maximal amplification equal to 100 Meter distance for the Falcon LC II or 200 Meter for the Falcon LLC.

9.4 Detected object

For the detection of pedestrians, making short and partial contrary moves with body and extremities, a short measurement distance over which speed data are measured is needed in contrary to quite continuously moving vehicles. To set the optimal detection parameters for vehicle or pedestrian detection insert <ESC> and then <O>.

!Detected direction:

!<0> for vehicle

!<1> for pedestrian

!Select:

Additionally the setting <1> for „pedestrian“ will suppress the processing of object speeds faster than 20 km/h.

9.5 Relay hold time

The relay hold time is the time interval for which the relay is switched over when a vehicle is detected before it falls back. This time interval is elongated for the time a vehicle passes the radar beam.

The hold time can be changed after insertion of <ESC> and then the <H> to valid values between 125 and 6350 milliseconds in 25 ms steps. Other whole numbers in this range, not multiple of 25, are automatically rounded down to the next multiple of 25. For example the input of 235 ms is rounded to $9 \times 25 = 225$ ms.

For the insertion of illegal values out of range the input is repeated:

!Relay hold time=8235

!Relay hold time=

The relay hold time is set in counting application to short times e.g. 150 ms, because this number is also used as timeout after detection signal loss by the detector to determine the vehicle ended. In vehicle queues the gap in between the vehicles can be quite short, the relay hold time must be set even shorter to discriminate single vehicles.

For speed tracking applications long relay hold times (1000 ms) are common to overcome short breaks in the signal particularly at the first detection of the vehicle on high distance range where the signal is still quite small and unstable.

9.6 Relay „fail-safe“

For security relevant applications, where a power or detector fail shall be recognised immediately, the detector relay output can be used in fail-safe mode. Therefore the relay condition of "vehicle detected" is reversed and the open contact in "fail-safe" mode is used as the close contact in normal operation mode. In consequence the relay output indicates in power or detector fail situation the condition "vehicle detected" permanently. See also chapter relay switching condition and characteristics.

To bring the relay in fail-safe mode press the key <ESC> followed by <F> and the following selection appears:

!Relay fail safe, insert

!<0> for off

!<1>for on

!Relay fail safe=

With the insertion of the number <0> fail-safe mode is switched off, with the selection <1> fail-safe is activated. Other inputs are ignored.

9.7 Special functions

The menu is called by inserting a <ESC> and a following <S> character:

!Special Functions:

!<0> Turn special functions off

!<1> Permanent rain detection: off

!<2> Cyclic rain detection: off

!<3> Cyclic absence detection: off

!Select:

The menu also displays the on/off status of the single functions.

If you select „0“ all special functions are deactivated. Default value ex factory is deactivated. Only one special function can be activated at the same time. The special functions „permanent rain detection“ and „cyclic rain detection“ can only be activated if the detected direction is set to „oncoming“ traffic, see also chapter 9.2. If the setting of the „detected direction“ is changed, all special functions are deactivated.

9.7.1 Special function „permanent rain detection“

For overhead applications with steep measurement angle the special function „permanent rain detection“ was implemented. During heavy rain fall the rain drops may fall nearly parallel to the radar field vectors. Their reflected signal might be stronger than the signal of vehicles entering the beam diagonally. In such a case the detector might be blinded.

To avoid that vehicles not announced to a traffic light controller with an „all red logic“ never get a green time the detector sets the relay permanently, if he recognizes continuous movement in the leaving detection direction.

9.7.2 Special function „cyclic rain detection“

For overhead applications with steep measurement angle the special function „cyclic rain detection“ was implemented, see also the chapter above. In contrary to the „permanent rain detection“ the relay is only set cyclic all 60 seconds. The time the relay remains set is determined by the relay hold time, see also chapter 9.5.

9.7.3 Special function „Cyclic absence detection“

The special function „cyclic rain detection“ sets the relay if no vehicle could be detected for 2,5 minutes. The time the relay remains set is determined by the relay hold time, see chapter 9.5. Afterwards the 2,5 minutes absence timeout starts again and the cycle is repeated until a vehicle is detected.

This function realizes the „method of simulating the presence of an approaching vehicle ... if the MVD has not changed state for a period of 2.5 minutes...” according the British standard TR2147 Issue B „Microwave vehicle detection equipment for portable vehicle actuated traffic signals”, article 6.2 and 6.2.1.

9.8 Detection counter

The digital Falcon LC II includes a 16 bit upward overflow counter, counting in the range from 0 till 65535 for the addition of detected movements. The counter starts after power on with 0 and resets after vehicle no. 65535 to 0 again.

The counted detections can be questioned with the insertion of <ESC> followed by <C>:

Counted detections: 502

The counter can not be preset or reset via the serial interface.

Counted are all vehicles above the set speed threshold with the correct detection direction as set in the program parameters.

Be aware that the counting is only accurate if the detector loses the detection signal after each vehicle and sees a gap:

- the radar shadow behind each vehicle must be kept small, with the consequence that mounting angles are $\geq 45^\circ$ and the detector shall be mounted on shortest distance to the driveway as practicable (beam width length depends on distance to the detector).

- timely the inter vehicle gap must be larger than the set relay hold time, used internally as detection signal timeout, see also chapter 9.5. Typical hold times are between 125 and 200 ms

- If the detector is mounted above or aside several lanes of the same direction, vehicle detections may overlap in dense traffic. Due to this fact an accurate counting of single vehicles in dense traffic is not possible anymore. Above a certain traffic density the number of counted vehicles might even drop, due to the fact that no gaps after each vehicle can be seen by the detector anymore.

If such traffic density is expected the relay condition should be considered as measure for the traffic density or even a more expensive but lane selective detector should be used over each lane.

10 Relay characteristics and switching condition

If you use the relay for load currents above 100 mA the hard gold coating of the contacts will burn off. Afterwards the relay cannot be used to switch loads of some mA properly again.

Characteristics relay Fujitsu-Takamisawa NA5W-K	
Relay type	monostable, change-over switch
Contact material	Silver-alloy hard gold coated
Resistance	max. 50 mOhm (for 1 A and 6V DC)
Max. peak/permanent current	2A / 2A
Max. switching voltage ¹	250 VAC, 220 VDC
Max. switching power (AC/DC)	62.5 AV, 30 W
Contact switch-/fall back time	6 ms / 4 ms
Minimum load	0.01 mA at 10 mVDC

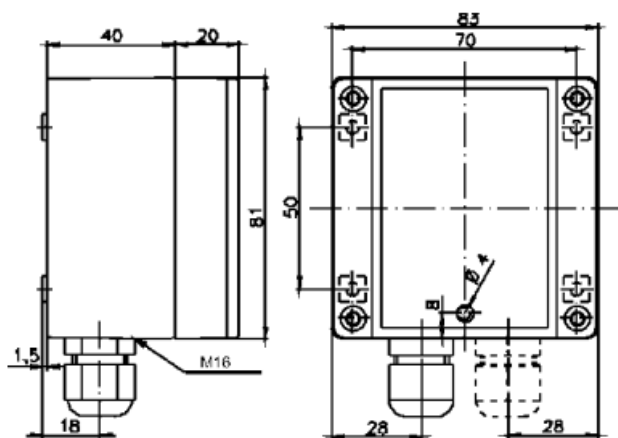
¹ for the whole Falcon LC detector are only 70 V DC and 50 V AC specified, see technical data

The following table shows the logic state of the relay during several operating conditions.

Operating condition	Switching condition of close contact with fail-safe set off	Switching condition of open contact with fail-safe set on
detector power off	open	close
detector initialises	close	open
no vehicle detected	open	open
vehicle detected	close	close

11 Housing

11.1 Housing measures and fixation



The housing measures are 83 mm x 81 mm x 61,5 mm (Length x Width x Height). The hole for the 4 x M4 fixation screws are positioned in the corners of a 50 mm x 70 mm rectangle.

The weight of the whole Falcon LC II is 220 grams.

The dotted cable gland is optional. It is only assembled if the Falcon LC II is equipped with a 230 Volt mains power supply for the power supply cable.

For information about the readymade ball-joint fixations for pole and wall mounting please contact us.

11.2 Housing material, protection class and cable feed

The housing material is light grey polycarbonate (RAL 7035), the cover seal is made of rubber.

The protection class is IP66/67, that means sealed against dust and resistive against water jets of all directions. The fixation holes are located outside of the sealed interior.

The standard cable feed is a polycarbonate cable gland with M16 thread, fitting for cable diameters from 5 till 10 mm. The housing is only sealed with feeded cable and closed cable gland.

External connector sockets with readymade coupling and cable are available on demand, please contact us for more information.

12 Connector terminals and switches on the PCB

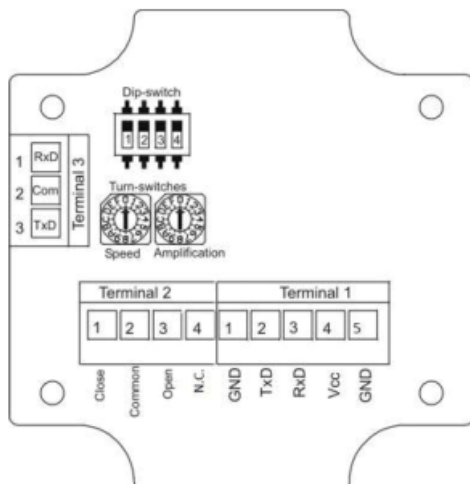


Illustration 7: PCB view from the bottom side

Illustration 7 shows the printed circuit board from the bottom side as it is seen if you take off the cover with the built in electronic from the housing bottom part.

Only connection terminal 1 and 2 are assembled if you buy the detector in standard version with RS232 interface.

Connection terminal 3 exists only on the PCB if the optional "serial current loop interface" is ordered.

Dip-switch and (hexadecimal coded) turn switches are only assembled in the optional version "manual parameter setting".

12.1 Connection scheme of the connection terminals

The connection terminals consist of spring force cage clamps, suitable for wire diameters till 1,5 mm².

The relay designation reflects the switching condition for the not powered detector.

Connector Terminal 1	
Pin	Signal
1	Ground
2	Supply voltage 7 - 60 V DC
3	RxD (receive data)
4	TxD (transmit data)

Connector Terminal 2	
Pin	Signal
1	Relay opening contact
2	Relay common contact
3	Relay closing contact

Connector Terminal 3	
Contact	Signal
1	RxD (receive data)
2	common contact
3	TxD (transmit data)

Connection terminal 3 is only built-in if the optional version serial current loop interface was ordered.

12.2 Falcon LC II with optional 230 Volt mains power supply

If the Falcon LC II is ordered with 230 Volt AC mains power supply a second power supply circuit board is mounted below the detector circuit board shown in chapter 12.

On the power supply circuit board the 230 Volt AC voltage is transformed and rectified to a 12 Volt DC voltage, with which the detector circuit board is supplied, see also chapter 12, Illustration 7.



Danger: Before you open the housing disconnect the 230 Volt mains supply voltage and take care against reconnection through third persons. Repairs shall only be done by trained electricians.

The 230 Volt mains power cable must be connected to the clamp terminal labelled „230 V AC Input“.

Additionally to the strain relief of the cable gland another strain relief clamp is located on the power supply pcb to which the power supply cable can be fixed with a cable tie.

The second strain relief clamp on the power supply pcb can be used for the signal cable.

The 12 Volt DC supply wires of the detector circuit board are connected to the clamp terminal 0V/12V respectively GND/12V. If the green LED is lit, the 12 Volt DC output voltage is present between clamps GND and 12V.

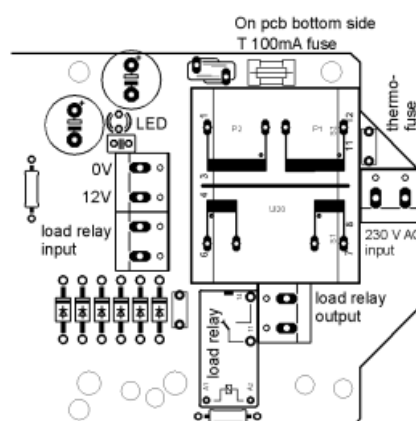


Illustration 8: 230 Volt mains supply circuit board

Located on the power supply is a load relay for AC loads till 6 Ampere and 250 Volt. The relay is switched by the small load relay on the detector circuit board at the „Relay Input“ clamps. This load relay has only one closing contact labelled „Relay Output“, switching reverse to the closing contact of the relay on the detector circuit board, see also chapter 10.

The 230 Volt primary transformer circuit has a 100 mA T (inert) fuse on the pcb bottom side. The secondary low voltage circuit is protected by a 0.2A polyfuse switch against overload. To reset the polyfuse remove the overload condition and power the detector off and on. Additionally a thermofuse against overheating of the transformer will protect the power supply.

Ratings Falcon LC II 230Volt Version	
Input voltage	230 Volt AC +10%/-13%
Maximal power consumption	3 Watt @ 230 Volt
Type of the heavy load relay	RE 300 from Siemens or Schrack
Maximal permanent/peak switching current	6 A / 15 A (4s pulse)
Nominal/maximal switching voltage	230 VAC/ 440 VAC
Maximal switching power relay	1500 VA AC
Relay contact material	AgCdO, AgNi, 15 µm gold plated ¹
Max. wire diameter clamp terminals	2.5/1.5 mm ² solid/stranded wire

¹ See chapter 10 concerning gold plated contacts and heavy loads

12.3 Version manual parameter setting

If the digital Falcon LC II is ordered in the version with "manual parameter setting" the parameters can be set by mechanical switches on the PCB, see also Illustration 7.

If the speed turn switch is turned out of position 0 the setting of the mechanical switches is read during detector initialisation after power on. Therefore a change of the mechanical switches is read and gets valid earliest after the next detector power on. If the speed turn switch is in position 0 the setting of the mechanical switches are ignored and the parameters are loaded from the EEPROM store.

Turn switch speed thresholds																
Position	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Speed table 1 in km/h	-	0	5	8	10	15	20	25	30	35	40	50	60	70	80	100
Speed table 2 in mph	-	0	5	10	12	20	22	30	32	40	42	50	52	60	65	70

The turn switch speed thresholds tables above show the vehicle speeds above which the relay is switched. Speed table 1 above is the delivered standard table with a km/h scale. Speed table 2 is delivered to the United Kingdom, or where miles per hour are demanded.

Tables with other speed values are delivered on demand against a once taken fee or free above a minimum order quantity of 5 detectors.

If the mechanical switch settings are valid and you make a serial connection as described in chapter 8, the help menu - *information* - **Interface: Hex-switch** is reported.

The table below lists the amplifier gain levels, which can be selected by turn switch amplification located on the PCB, see Illustration 7. Level 16 means maximal amplifier gain and hereby detection range.

Turn switch amplification																
Position	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Amplifier gain level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

With the dip-switches the detected direction, the relay hold time and the relay „fail-safe“ mode can be set.

DIP switch				setting
1	2	3	4	
on	on	-	-	detected direction oncoming only
off	on	-	-	bidirectional detection
on	off	-	-	bidirectional detection
off	off	-	-	detected direction departing only
-	-	on	-	relay hold time 1 s
-	-	off	-	relay hold time 150 ms
-	-	-	on	relay without fail-safe mode
-	-	-	off	relay in fail-safe mode

13 Optional serial current loop data interface

In this version the Falcon LC II is delivered with an additional connection terminal 3, see Illustration 7.

The serial current loop data interface allows connection cable lengths till 1 km at 9600 baud data transmission speed and isolates the radar detector electrically from the connection cable (galvanic isolation). The serial current loop is in contrary to the serial RS232/V24 interface with defined signal voltage levels not standardised. Usual but not necessary is a design with 20 mA loop currents (not shown in Illustration 9).

Illustration 9 shows the principle layout and resistor values on the Falcon LC II and the user side.

The twice given resistor values of R6 and R4 are for 5 or 12 Volt supply of the current loop.

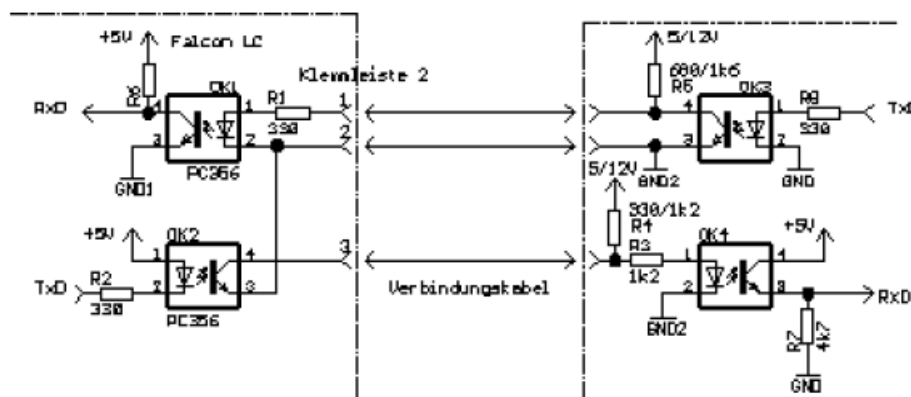


Illustration 9: Layout of a current loop data interface

The always built-in serial RS232 interface can be used further on. But on simultaneous reception of data by both interfaces the data will be corrupted.

Maximum ratings opto-coupler Sharp PC365		
Isolation voltage	V_{iso}	3750 Volt _{rms}
Diode-/collector current	I_F/I_C	50 mA / 50 mA
Collector-emitter voltage	U_{CE0}/U_{ECO}	+ 80V / - 6 V
Power dissipation	P_{tot}	170 mW

14 Technical data/ ratings¹

digital FALCON LC II/LCL II	typical	min./max./remarks
Supply voltage:	12 V DC	7 ... 60 V DC
Current consumption:	60 mA @ 12V DC 35 mA @ 24V DC standby, relay not switched	80 mA @ 12 V DC 45 mA @ 24V DC relay switched
Relay data (see chapter 10):	max. current/power/voltage: 2A/30W/70V DC, 2A/62W/50V AC	Open-/close-/common contact
Distance range (passenger cars in free field)	LC II 100 Meter LCL II 200 Meter	LC II 70 ... 150 Meter LCL II 180 ... 250 Meter
Distance range reduction:	16 amplifier gain levels ²	
Speed measure range:	0,5 - 255 km/h	resolution 1 km/h
Detected direction:	oncoming/leaving/bidirectional	
Transmit frequency:	24,165 GHz, K-Band	
Radiated power:	< 5 mW	EIRP ≤ 20 dBm
Antenna characteristic	28° x 28°, radial symmetric	at 3 dB points
Speed thresholds	0 till 255 km/h ²	in 1 km/h steps
Hold time relay	125 ms till 6,35 s ³	in 25 ms steps
Serial RS232 interface	9600 baud, 8 data-, 1 stop bit, no parity, no handshake	
Housing (material, colour)	polycarbonate, light grey (RAL7035)	
cable feed	M16 cable glands	for Ø 5 - 10 mm
Connection terminal(s)	spring force cage clamps	for wire Ø 1,5 mm ²
Measures	83 x 80 x 61 mm	
Weight (12V/230V version)	250 g / 350g	
MTBF @ 70° C	MTBF > 130.000 h	
Operating temperature:	- 40°C < T < 70°C°	
Standards/ conformity	EN300440, EN301489, EN50293	CE, ROHS

¹ Subject to technical change

² With option manual parameter setting - Selection with hex-switch out of 15 factory predefined values

³ With option manual parameter setting - Dip-switch selection between 150 ms for counting or 1 s for speed tracking

15 CE-Conformity declaration and registration

15.1 CE Declaration of conformity

Declaration of Conformity

in accordance with the EC-directives 2014/53/EC (RED) and 2011/65/EC (ROHS)

The manufacturer: Via traffic controlling GmbH

Declares that the product: digital Falcon LC II and LCL II / viafalcon LC II and LCL II

Intended purpose: Short range device – vehicle motion detector

Type: Radio equipment Equipment class: 1

Complies with the essential requirements of article 3 of the RED directive, when used for its intended purpose:

Health and safety requirements pursuant to article 3 (1) and low voltage directive 2014/35/EC

Protection requirements concerning electromagnetic compatibility article 3 (1) b and EMC directive 2014/30/EC

Air interface of the radio systems pursuant to article 3 (2) of the RED 2014/53/EC directive

Harmonised standards applied:	Other means of providing conformity with the essential requirements (standards, specifications):
EN 50293: 2013-02	Reg TP 321 ZV003: 1999-06
EN 55022: 2011-12	DIN VDE 0832-100 (HD638S1, BS7987): 2007-12
EN 61000-6-2/-4: 2008-03/2011-09	
EN 62311 (VDE 0848-211): 2008-09	
EN 300440(V2.1.1): 2017-03	
EN 301489-1/-3(V2.1.1/V1.6.1): 2017-04/2013-08	
EN-60950-1 2006 + A11:2009 + A12:2011 +A1:2010 +A2:2013	

Furthermore complies the product digital Falcon LC/LCL II with the requirements of EC directive 2011/65/EC (ROHS).

Address: Via traffic controlling
Campusallee 1
D-51379 Leverkusen

Place, date: Leverkusen, 10 May 2017

Name and signature: Dipl.-Ing. (FH) J. Geßler
Technical director



15.2 Radio licensing and registration

The digital Falcon LC was tested by an accredited test laboratory according to the standards ETSI EN 300440, EN 301489 and EN 50293 and can be operated within the European Community including Norway. Additional national licences concerning EMC or radio emission matters are not necessary within the European Community, restrictions concerning the operation of the Falcon LC are yet not known.

A registration according to EC directive 2014/53/EC (RED), article 5(1) is not needed for radio class 1 equipment, because the Falcon LC II operates in the EC wide harmonized frequency band 24.15 till 24.25 GHz (EC decision 2013/752/EC, band no. 70a) and is conform with EC standards.

Although Switzerland and Norway do not belong to the EC countries they adopted the EC regulations and radio equipment class 1 systems need not be notified there anymore.

16 Electrostatic discharge precautions

The digital Falcon LC detector assembled inside the housing is completely protected against electrostatic discharge.

Attention: When the detector is opened for cable assembly or adjustments the detector semiconductor components are in danger of destruction due to electrostatic discharge.

Precautions:

- Inform your personal about precautions against electrostatic discharge destruction. Let the detector be handled only by taught persons. Take care that the personal of your installation contractor is informed as well.
- In the factory, work at electrostatic discharge protected work places, with grounded conductive bracelets, mats, tables, floors, shoes, dresses and transport containments as far as possible.
- Transport the detector only in the closed housing.
- Under field conditions take care for electrostatic charge compensation before touching or laying down the open detector. Never hand out the open detector to another person before touching the person.

Handle the detector always at the housing cover, avoid touching the circuit board!



Attention: Electrostatic sensitive device