

## Digital SSI Converter

# DIGICON/V3

Typ: DK SI/V3 and DK SI/V3/BTL5



## Digitronic Automationsanlagen GmbH

Auf der Langwies 1 • D - 65510 Hünstetten-Wallbach • Tel. +49 6126 9453-0 • Fax -42  
Internet: <http://www.digitronic.com> • E-Mail: [mail@digitronic.com](mailto:mail@digitronic.com)

### Notification

This handbook corresponds with the unit version of 3/2019 and applies to the DK SI/V3 as well as the DK SI/V3/ BTL5 option. The company Digitronic Automationsanlagen GmbH reserves the right to implement changes that result in an improvement of the quality and the functions of the device at any time and without any announcements.

This instructions manual was created with a maximum of care, but mistakes are not out of the question. We are thankful for any comments, regarding possible mistakes in the instruction manual.

### Update

You can also obtain this instruction manual on the Internet at <http://www.digitronic.com> in the latest version as PDF file.

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**Note:** This device fulfills the following norms: DIN EN 61000-6-2, DIN EN 61000-4-2, DIN EN 61000-4-4, DIN EN 61000-4-5, DIN EN 61000-4-8 and DIN EN 55011 and RoHS 2 (2011/65/EU)..



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Digitronic Automationsanlagen GmbH  
Auf der Langwies 1  
D-65510 Hünstetten - Wallbach  
Tel. (+49)6126/9453-0 Fax. (+49)6126/9453-42  
Internet: <http://www.digitronic.com> / E-Mail: [mail@digitronic.com](mailto:mail@digitronic.com)

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## 1. Introduction

DIGICON DK/SI/V3 converts the RS422 SSI signals of your absolute measuring system into incremental signals of a RS422 level. These you can then connect to the incremental input of e.g. a position controller. DIGICON DK/SI/V3 links the advantage of an absolute activation point with the ability to initiate an external Clear signal.

The version 3 of the DIGICON described here is a new development, as the DK SI/V2 can no longer be produced.

The DK SI / V3 is largely compatible with the DK SI / V2, but offers additional options and improvements such as a higher processing speed and more flexible settings for the SSI measuring system. The Balluff BTL5 option is also available in version 3.

In addition, a 24VDC input has been integrated to enable / start the pulse output after power on. As a result, it is no longer necessary to delay the switching on of the power supply of the DIGICON with respect to the supply of the positioning control. Version 2 of the device attempted to achieve this by a fixed delay of 10 seconds, which in many cases was not sufficient.

**Note on V2:** The 2nd incremental output of the DK SI / V3 is no longer supported or controlled since the quadrupling is now set via the DIP switch and output via the 1st incremental output.

### Features:

- Supply voltage: 24V DC  $\pm 20\%$
- Current consumption 100mA without load or without connected SSI interface
- For SSI signals from 9 bits up to 26 bits
- SSI listening mode
- Rotatory or linear evaluation possible.
- Absolute or relative mode.
- Optionally also suitable for binary encoders (DK SI/V3/BIN).
- 1 \* Incremental output with adjustable frequency as well as one or four flank output.
- Cycle time min. 0.08ms / max. Approx. 0.150ms depending on the set master clock frequency
- Transmission level (SSI master) RS422 (clock, data), incremental outputs: RS422 (A,B,C).
- 4 x 24VDC inputs and outputs for special functions or incremental output enable.
- Screw terminals comply with IP20.
- Snap-on mounting on symmetrical support rail according to EN 50 022, can be arranged in rows.
- Degree of protection housing corresponds to IP20.
- Working temperature 0 ° C to + 55 ° C.
- Weight about 100g
- Balluff BTL5 option (Out of Range Bit).

## 2. Installation

Before installing the device, configure the DIGICON or adapt it to your application. The adaptation is carried out by means of DIP switches. Please observe chapter "6. The DIP - switches or the configuration" on page 8.

The device is snapped onto an "EN mounting rail" in the control cabinet (see chapter "4. Dimension" on page 6). The grounding connections and cable shields must be positioned in the shortest possible way on a series earth terminal to be arranged next to the device. The grounded mounting plate and its electrical connection to the EN mounting rail ensure optimum dissipation of the interference to the shield. All cable connections must be made in a de-energized state! Use only shielded, twisted pair cable. Do not lay the cable parallel to power cables. If possible, place the shield on both sides.

## 3. Commissioning

Connect DIGICON according to the pin assignment with the measuring system and the position controller. See also chapter "5. Pin assignment" on page 7 and note chapter "6. The DIP - switches or the configuration" on page 8.

After switching on the controls or positioning or the voltage supply at terminals 21 - 24, the DIGICON receives its power supply and forwards them to the master SSI position measuring system.

If the power supply is on, "The Status LED" indicates the operating status of the device.

In order to start the pulse output on the incremental output, the DIGICON requires a release or enable signal (+ 24VDC) at the 1st 24VDC input (terminal 27). This function was not available in version 2 of the DIGICON and is specifically intended for booting up the controller after switching on the power supply. As a result, the downstream control or positioning receives pulses only when it applies a ready signal to the input.

If the DIGICON is operated in absolute mode, a clear signal is output after switching on the power supply and applying the enable and then counting up to the value of the connected position measuring system.

This process can take up to 120 seconds with long paths and low clock frequency and must be taken into account in the switch-on logic.

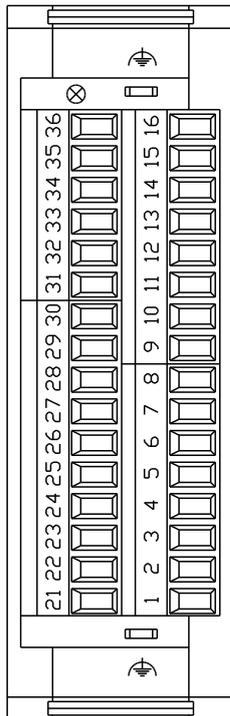
### 3.1. The Status LED

The DIGICON V3 has a yellow status LED that indicates the operating status of the device.

LED	Possible causes	Troubleshooting
dark	There is no power supply to the DIGICON or the device is defective.	Check the voltage supply, this must be 24V DC $\pm 20\%$ or replace the device.
flashes evenly	There is an SSI protocol error. The number of data bits is wrong. The set clock frequency for the laid cable length is too high.  With the BTL5 option, the magnetic sensor has left the measuring range of the BTL5 (Out of Range)	Check the measuring system or the encoder and the connecting cables. Reduce the master clock frequency or check the settings of the DIP switch S1 and compare them with the parameters of your position measuring system for compatibility.  Move the magnetic sensor of your Balluff BTL5 sensor back into the measuring range.
flashes sporadically	There is a sporadic SSI protocol error. The clock frequency for the misplaced cable length is too high. A wrong non-stranded and shielded SSI cable is used. The SSI cables were laid near high power lines.	Reduce the master clock frequency.  Use a shielded twisted pair cable designed for RS422 SSI data transmission.  Change the cable guide and check the functional grounding and the connection of the cable shielding.
shines	OK – no error	-

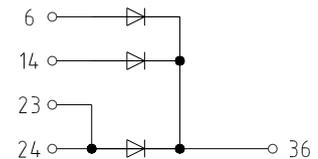


## 5. Pin assignment



### 5.1. Pin assignment Power supply

Clamp	Name / function
21	0V Power supply
22	0V Power supply
23	+ 24V DC Power supply
24	+ 24V DC Power supply
25	0V
26	0V
27	Enable input
28	Inp./Output 2 (not used)
29	Inp./Output 3 (not used)
30	Inp./Output 4 (not used)



### 5.2. Pin assignment SSI Input (Master)

Clamp	Name / function
31	0V Encoder power supply
32	Data A (+) of the Encoder
33	Data B (-) of the Encoder
34	Clock A (+) of the Encoder
35	Clock B (-) of the Encoder
36	+ 24V DC Encoder power supply

### 5.3. Pin assignment of the incremental output

Clamp	Name / function
1	0V Power supply
2	A pulse (+) RS422
3	A pulse (-) RS422
4	B Pulse (+) RS422
5	B Pulse (-) RS422
6	+ 24V DC Power supply
7	Clear (+) RS422
8	Clear (-) RS422

### 5.4. Pin assignment clamp 9 -16

Terminals 9 - 16 or the signals on terminals 10 - 13 and 15 and 16 are currently not used.

**Note on V2:** On these connections, one edge was send at the incremental output for each SSI step. This is set with version 3 via DIP - Switch and only possible for terminals 2 - 5.

### 5.5. Pin assignment clamp 27 / Enable Input

Clamp	Name / function
27	Enable

The pulse output on the incremental output is only started after Power UP when this input goes high (+ 24VDC is applied). Ready signal of the controller.

**Note:** The clamp 21, 22, 25, 26, 31, 1 and 9 are internally connected.  
The clamp 23 and 24 are internally connected.

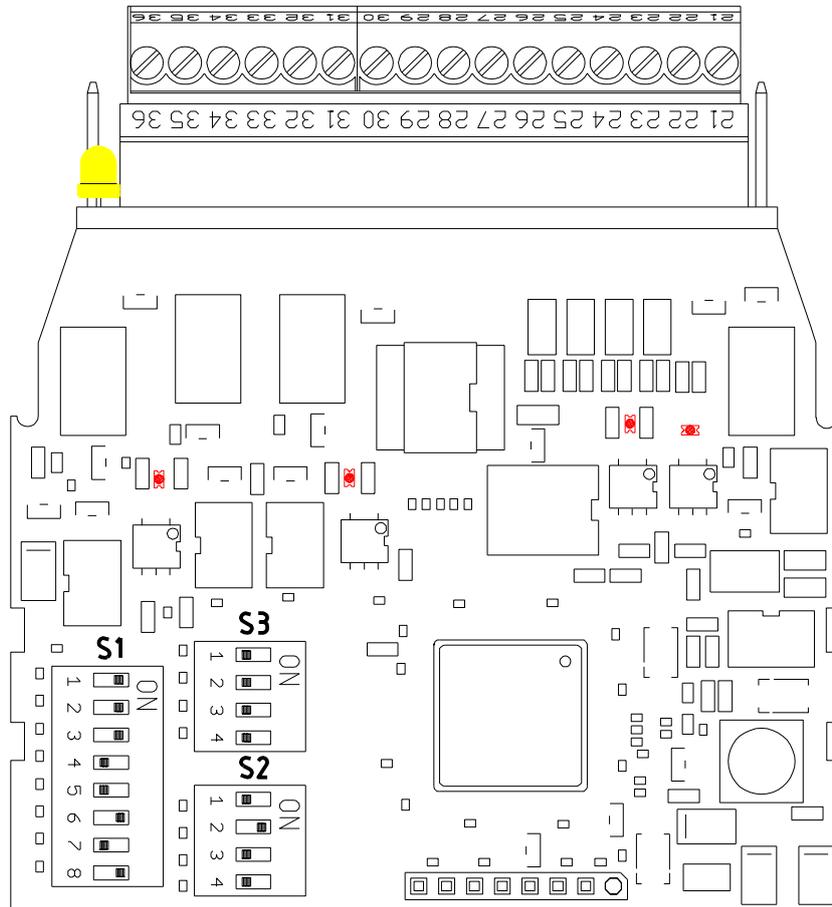
**Attention:** All connections marked as not used at the moment should not be assigned!

## 6. The DIP - switches or the configuration

The three DIP - switches in the device allow the DIGICON to be configured for a wide variety of applications.

In order to be able to change the DIP - Switch position of the DIGICON, the device must be opened. The housing can be pushed apart by means of a screwdriver in the middle.

**Attention:** Please take care not to damage the circuit board or components with the screwdriver.



### 6.1. Factory setting of the DIP - switches

In the factory or default setting of the DK SI/V3, the DIP - switches are set as follows (see picture above):

DIP - Switch S1 : Switch 1 - 3 = ON, 4 + 5 = OFF, Switch 6 = ON, Switch 7 = OFF and 8 = ON.

DIP - Switch S2 : Switch 1 = OFF, Switch 2 = ON, Switch 3 + 4 = OFF.

DIP - Switch S3 : Switch 1 - 4 = OFF (Switch S3 is currently not used).

This corresponds to the following parameters:

- Master clock frequency 519 kHz.
- 24 data bits are evaluated in linear mode.
- For each SSI increment, an edge change is output on the incremental signal, with max. 72 kHz output frequency.
- The relative mode is active.
- In the case of an SSI error, the incremental output is frozen (hold).

## 6.2. DIP - Switch S1 (Master Clock)

The DIP - Switch S1 is used to set the Master SSI interface (terminal 31-36), the absolute / relative and the linear / rotary mode of the DIGICON.

### 6.2.1. DIP - Switch S1 : Switch 1 (SSI Master - or listening - mode)

Switch 1 of DIP - Switch S1 activates the SSI listening mode of the DIGICON.

Switch 1	Setting SSI listening mode (Clamp 34 + 35)
ON	Mastermode / Clock comes from the DIGICON (default)
OFF	Listening mode (max. 750 kHz)

#### Note on the listening mode:

In the listening mode, the DIGICON no longer generates its own clock, but triggers an externally applied clock signal (listen in) (maximum 750 kHz) at clamp 34 and 35.

### 6.2.2. DIP - Switch S1 : Switch 2 (Incremental - output - mode)

Switch 2 of DIP - Switch S1 sets the mode of the incremental output.

Switch 2	Incremental - Output - Flank mode (Clamp 2 - 5)
OFF	For each SSI Step, one edge change at the incremental output (quadruple evaluation).
ON	For each SSI Step, four edge change at the incremental output (single evaluation)

### 6.2.3. DIP - Switch S1 : Switch 3 - 4 (Clock frequency)

Switches 3 and 4 of DIP - Switch S1 determine the SSI clock frequency in the master mode of the DIGICON.

This is necessary for SSI data transmission in order to be able to adapt the clock frequency to the cable length or if the position measuring system or the encoder does not support the clock frequencies.

Switch 3	Switch 4	Clock - frequency (recommended)
ON	ON	130 kHz (up to max. 300 meters cable length)
OFF	ON	259 kHz (up to max. 100 meters cable length)
ON	OFF	519 kHz (up to max. 30 meters cable length)
OFF	OFF	692 kHz (up to max. 10 meters cable length)

**Attention:** If the clock frequency for the cable length or the measuring system (encoder) is too high, sporadic data errors or SSI protocol error messages may occur!

#### 6.2.4. DIP - Switch S1 : Switch 5 - 7 (Number of SSI data bits)

Switches 5 - 7 of DIP - Switch S1 can be used to set the number of SSI data bits to be evaluated or the resolution. This is necessary to get the optimal / minimum cycle time.

Switch 5	Switch 6	Switch 7	Resolution / Number of data bits / Clock's
ON	ON	ON	512 / 9 / 11 (single turn)
OFF	ON	ON	1024 / 10 / 12 (single turn)
ON	OFF	ON	2048 / 11 / 13 (single turn)
OFF	OFF	ON	4096 / 12 / 14 (single turn)
ON	ON	OFF	8192 / 13 / 15 (single turn e.g. AAG615-8192)
OFF	ON	OFF	4096 * 4096 / 24 / 26 (multi turn / linear e.g. AAG626)
ON	OFF	OFF	8192 * 4096 / 25 / 27 (multi turn / linear) (default)
OFF	OFF	OFF	8192 * 8192 / 26 / 28 (multi turn / linear)

**Note:** With DK SI/V2, the number of data bits could not be set. 24 data bits (25 clocks) were always evaluated. Occasionally, this caused problems when reading or recognizing the SSI error bit.

**Note BTL5:** With the DK SI/V2/BTL5 option, the number of SSI data bits could be changed by the DIP switch from 24 to 25 bits.

Also note the order nmb. of the BTL5 sensor in the new DK Version 3 and set the correct number of data bits.

Type: BTL5-S1 12-M0300-P-S32 **1** = 24 bit

Type: BTL5-S172-M0250-P-S32 **7** = 25 bit

**Attention:** If the number of data bits is not set correctly, the "Out Of Range" bit will not be properly monitored.

#### 6.2.5. DIP - Switch S1 : Switch 8 (Evaluation mode - linear / rotary)

The switch 8 of the DIP - Switch S1 selects the linear or rotary mode.

Switch 8	Linear or rotary mode
ON	Linear - Mode (default)
OFF	Rotary - Mode (only for single turn encoders)

This function was not available for the DK SI/V2. It is necessary because the DK SI/V3 can now also read SSI single - turn encoders.

For an SSI single - turn encoder, the mode must be set to "Rotary". This prevents the return of the incremental output when the encoder has its zero crossing. During the encoder zero crossing, the clear signal of the incremental output is additionally activated and the output of the incremental pulses is continued.

For a linear measuring system, such as the Balluff BTL5 linear scale or multi turn encoders (up 24bit), the linear mode must be set here (Switch 8 = ON).

### 6.3. DIP - Switch S2 (Setup - Incremental - output)

This DIP - Switch is used to set the additional parameters of the incremental output.

#### 6.3.1. DIP - Switch S2 : Switch 1 + 2 (Maximum - Incremental - Pulse - Frequency)

Switch 1	Switch 2	Incremental - Pulse - Frequency
ON	ON	36kHz
OFF	ON	72kHz (default)
ON	OFF	144kHz
OFF	OFF	288kHz

With the DK SI/V3, in contrast to version 2, it is possible to set the maximum incremental pulse output frequency independently of the SSI clock frequency.

Use switches 1 + 2 of DIP - Switch S2 to select the frequency that the position measuring input of your controller can still reliably detect.

Can the position measuring input of your controller record a maximum of 100kHz, so the output frequency may be set to a maximum of 72kHz.

#### 6.3.2. DIP - Switch S2 : Switch 3 (Error - Mode)

Switch 3	Behavior of Inc. output in case of error (start/stop bit wrong)
ON	The incremental output is set to 0.
OFF	The output at the incremental output is frozen (default).

If a SSI Start - or Stop - Bit missing at the SSI input, for example in the event of a cable break, the incremental output is set to 0 and the clear signal is set, if this switch is set to ON.

If the switch is OFF, the output of incremental pulses is set or frozen in the event of an error. After eliminating the error, the pulse output will continue.

#### 6.3.3. DIP - Switch S2 : Switch 4 (Evaluation mode - absolute / relative)

Switch 4	Evaluation mode - absolute / relative
ON	Absolute - Mode
OFF	Relative - Mode (default)

If the switch 4 = ON, the absolute mode is activated. When switching power on, the read in SSI value is output as incremental pulses at a time in order to bring the connected controller to this value.

In relative mode, only the changes in the SSI value are output as incremental pulses from the power on time of the DIGICON, unless the SSI position measuring system sends the actual value 0. In this case, the clear signal of the DIGICON becomes active.

To synchronize the connected controller after switching on, please use the enable - input. Please also note chapters "5.5. Pin assignment clamp 27 / Enable Input" on page 7.

After applying a 24VDC signal to the enable input, a CLEAR pulse is issued and then the StartUP Incremental pulses are sent.

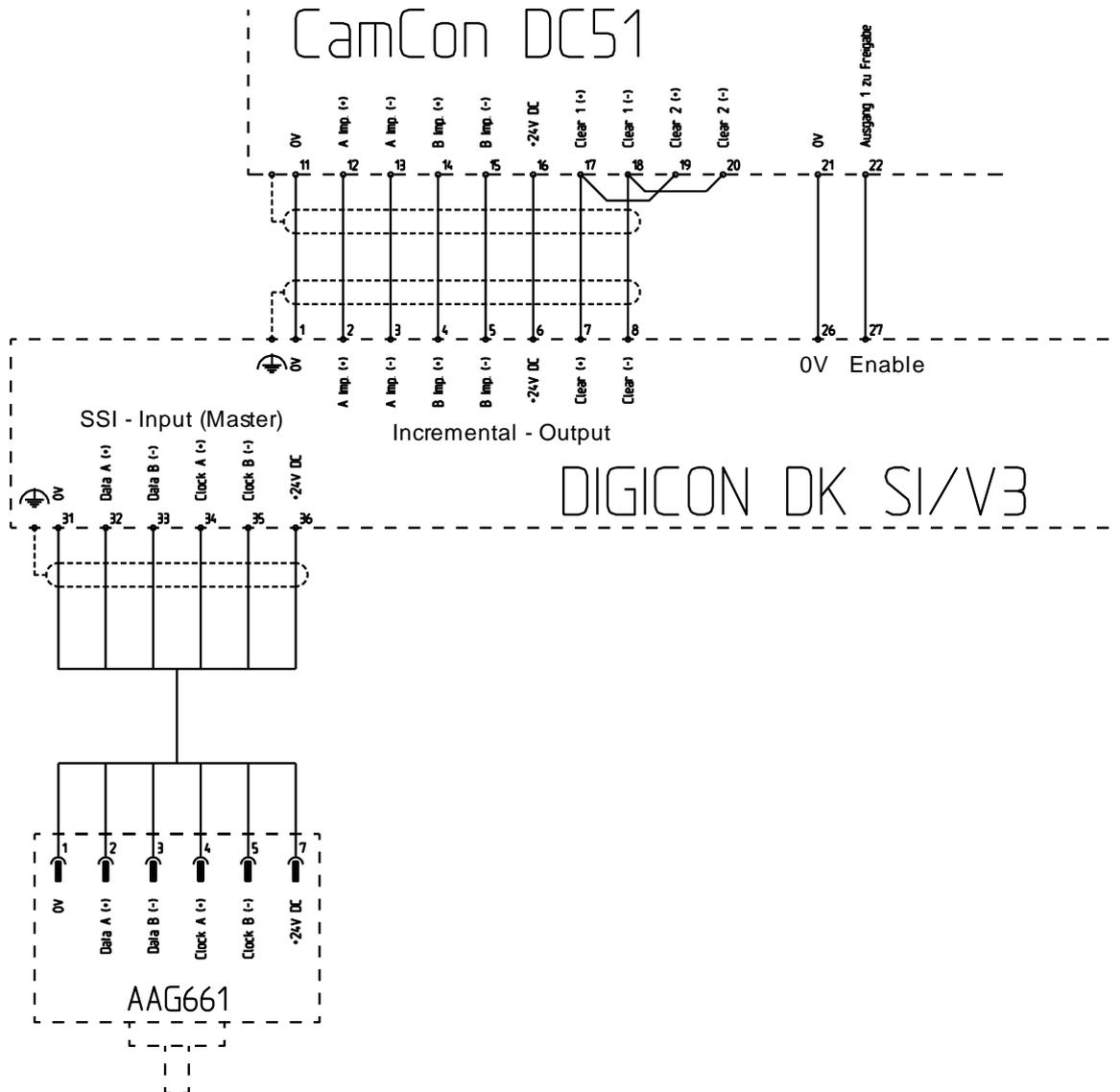
### 6.4. DIP - Switch S3 (not used)

This DIP switch is not used with DK SI/V3.

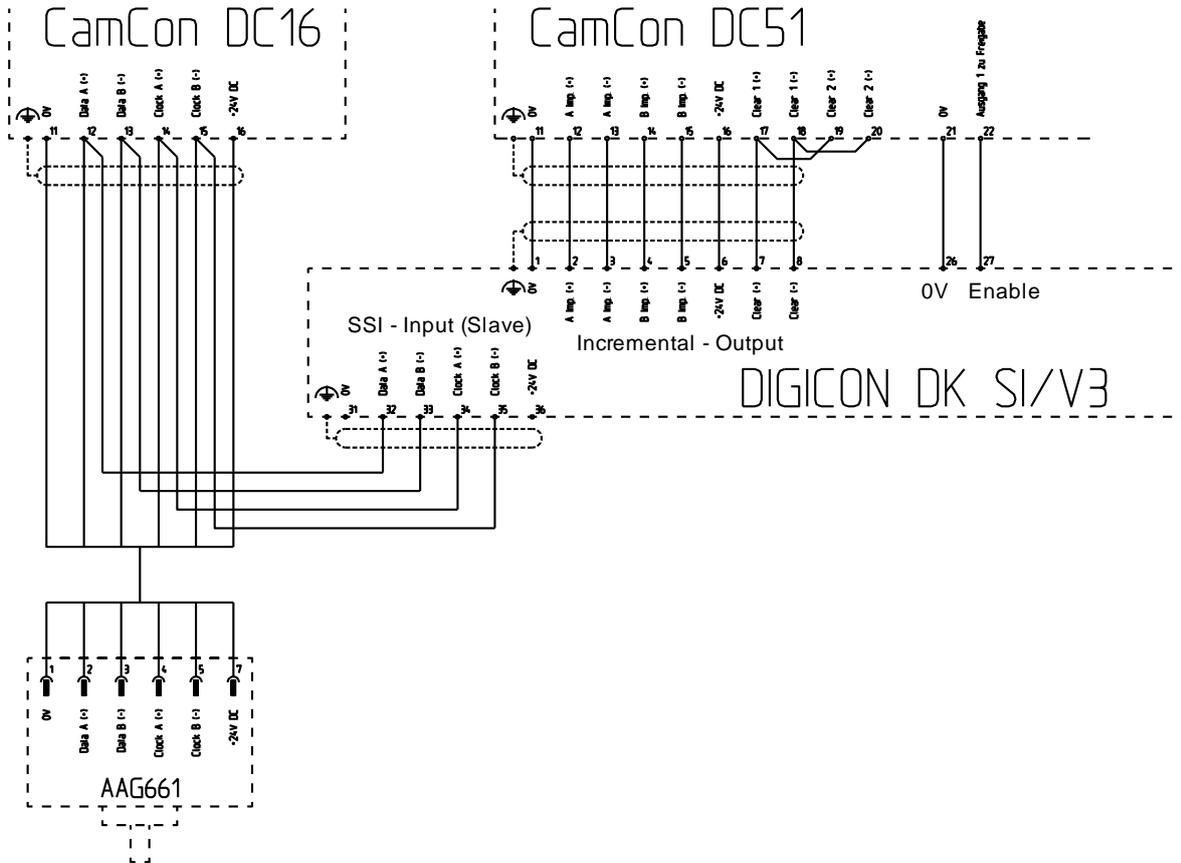
**Note:** All DIP - Switches which are free or not used marked must be set to OFF.

7. Connection examples

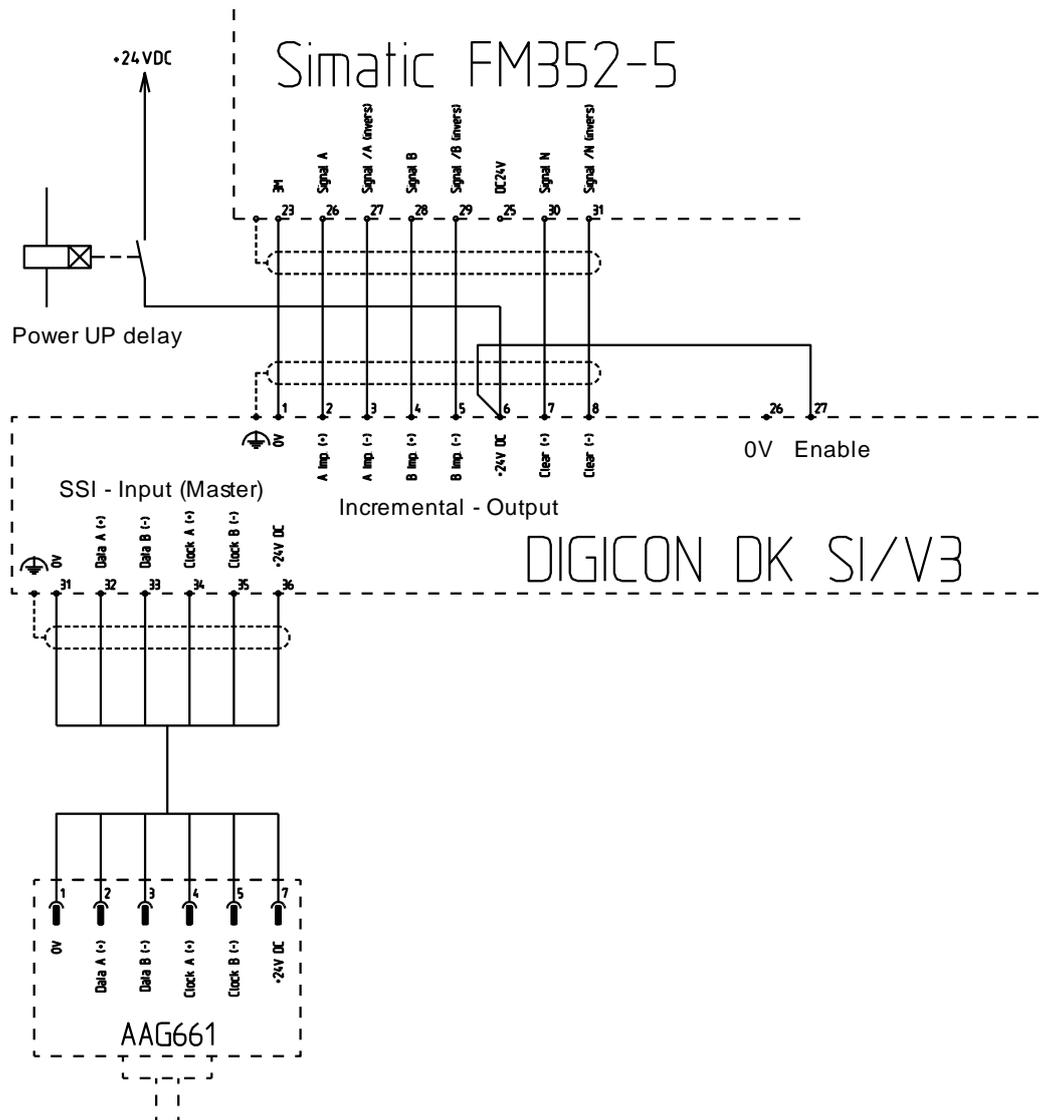
7.1. Connection example for DIGICON as SSI - Master (default)



7.2. Connection example for DIGICON as SSI - Slave in listening mode



7.3. Connection example for DIGICON as SSI - Master and a Siemens FM352-5



In this example, the DK SI/V3 is connected to a Simatic FM352-5 cam controller. This controller can not provide a release or enable signal for the DIGICON.

For this, the enable signal can be permanently set to 24V and the operating voltage of the DIGICON, as with a DIGICON version 2, are only switched on via a switch-on delay when the Simatic controller is ready.

### 8. Device option Balluff - BTL5

If the magnetic sensor of a Balluff BTL5 transducer leaves the scanning range, the transducer sets the "Out of Range bit" (Bit3) in the SSI data signal, however, this bit is a "normal" data bit. The DIGICON means an actual value change that the device transmits on the incremental interface.

Optionally, the DIGICON DK SI/V3 can be equipped with a Special software "BTL5", which monitors the "Out Of Range Bit" and, if necessary, the output of the incremental pulses. If the magnetic sensor is moved back into the scanning range, the pulses continued without the pulses being lost or additionally pulses.

Under the order number: "DK /SI/V3/BTL5" you will receive the DIGICON with this option.

## 8. Technical data

Power supply .....	24V DC +/- 20% via the power supply of the controllers connected to the outputs.
Current consumption.....	100 mA without load.
Display.....	1 x yellow LED for operational readiness or error.
Input (SSI Master).....	1 * synchronous serial (SSI) RS422 Gray code
Output (1 x RS422 Inc.) .....	1 * incremental output RS422
Logic inputs / outputs .....	4 * 24V PNP inputs / outputs for options 1 * Input for Enable the incremental output after power up.
Transmission width .....	9 to 26 data bits. See also chapter "6.2.4. DIP - Switch S1 : Switch 5 - 7 (Number of SSI data bits)".
Cycle time .....	synchronous to the SSI master reading: approx. 80µsec - 150µsec depending on the set master clock frequency or by the adjacent clock in listening mode at the master input (DIP switch S1: Switch 1).
SSI Master Input.....	Clock frequency 130, 259, 519, 692 kHz or external (750kHz max.). depending on the set master clock frequency. (DIP - Switch S1: Switch 3 + 4)
SSI master mono flop time .....	typ. 62µs.
Transmission level.....	RS422, one-sided galvanic isolation.
Incremental output.....	1 or 4 edge change per SSI increment, (DIP - Switch S1: Switch 2).
Pulse frequency output .....	36kHz, 72kHz, 144kHz, 288kHz (DIP - Switch S2: Switch 1 + 2).
Housing .....	flame retardant thermoplastic resin, continuous temperature up to 100°C
Connections.....	screw terminals
Connection cable.....	shielded cable, max. length between measuring system and DIGICON 300 meters depending on the set clock frequency.
Mounting.....	convenient snap-on mounting on symmetrical mounting rail according to EN 50 022, can be arranged in rows.
Disassembly .....	by pulling back the latch.
For dimension.....	see chapter "4. Dimension".
Degree of protection .....	housing corresponds to IP20.
Working temperature .....	0° to +55°C.
Weight.....	approx. 100g.