Wirescanner Technical Manual

Version 1.06

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II. Overview

This manual should help the operator, to understand, what kind of actions must be done to do a SLOW- or FAST scan. To use all functions of the wireStepper_server, the following hard- and software requirements are needed:

A. Hardware requirements:

IP-Stepper (SBS-Greenspring)
IP-Digital 24 (SBS-Greenspring)
IP-Timer

B. Software requirements:

wireStepper_server
ipdigi_server
iptimer_server
wirescanner_server

III.Global Actions for SLOW- and FAST Scans

A. Reset and Calibrate Heidenhain rulers:

this option is used only at the very beginning of the initialisation of the wirescanner system, or after a reboot of the system.
to reset the haidenhain rulers, the following actions shuld be done:

1.) DIG3 = 0, enable the IM1007
2.) DIG1 = 1, enable the Z-pulse from the Heidenhain rulers, disable the timing system.
3.) DIG2 = 1, enable the right end switch
4.) set “STEPS TO MOVE” property in the "wireStepper_server" to ex.: -100000 and let it run. A negative sign is important, because of the endswitch. The stepper will now run as long the right end switch is not reached. If it will be reached, the stepper stops emediately.
5.) (optional) set “ACTUAL POSITION” property in the "wireStepper_server" to “0”, to remember, that this is the start position of the stepper counter
6.) set “STEPS TO MOVE” property in the "wireStepper_server" to 400 (if DIG4 = 0) or to 51200 (if DIG4=1). Both values will force the motor to make one turn. The Heidenhain ruler will cross then his own reference swich and will reset itself. This will also set the direction signal to "1", whis is necessary for the fast scan mode.
7.) DIG3 = 1, disable the IM1007 (take out the current off the stepper motor)

Now the Heidenhain ruler is calibrated and ready for use.

IV. SLOW SCAN Mode

The slow scan mode is much easier to handle, than the FAST SCAN Mode. Here we have a permanent readout of the Heidenhain rulers. The resolution of the stepper driver is set to 51200 micro steps, what means, that the smalest movement is about 2.7 μm. The direction of the movement is POSITIVE (all steps have to be positive)

A. load stepper conditions (slow scan)

1) this option has to be done every time before the first slow scan will be made.
2) DIG 1 = 1, to disable the timing system from the IP-Quadrature
3) DIG 2 = 1. Enable endswitch
4) DIG 3 = 0. Enable IM 1007
5) DIG 4 = 1, select a resolution of 256 microsteps (Slow Scan Mode)
6) DIG 5 = 1, start the slow scan only triggered by the software, disable function of DIG1 and GATE0

B. start a SLOW SCAN

7) set in the "wireStepper_server" the number of steps, the stepper shall move. Just after this, the stepper will start and stop exactly at the point you wanted to go to.

ATTENTION: the predefined current (hardware: resistor at the IM1007) will drive the

motor until a predefined time (15 sec) is over. After this time the wirescanner will move alone out of the beam and is also loosing his position.

C. after a SLOW SCAN

8) DIG 3 = 1. Disable IM 1007, to pevent it for demaging because of high current

V. FAST SCAN Mode

The Fast Scan Mode is only for high speed moving. It differs in many points from the SLOW SCAN Mode. The speed of the wirescanner is 1 m/s. The movement is continous and we have only four waypoints, mesured by one Heidenhain ruler in connection with the IP-Quadrature of SBS-Greenspring. The Fast Scan will turn the Motor **anti-clock-wise**.

At the start, the Wirescanner has to be in the endswitch.

A. load stepper conditions (FAST SCAN)

All items of the follwing list have to be made every time, without the marked (✱) ones

1.) DIG3 = 0. enable IM 1007

2.) Dig 5 = 1; disable DIG 1 and timing system

3.) DIG1 = 0-1-0; to reset the Flip-Flop (FF) at the hardware. The FF is used for the timing signal in case the timing signal is shorter, than the wirescanner needs to get out of the area of the endswitch. Also DIG 1=0 sets the IP-Quadrature counter into the fast-scan-count mode. (only 4 waypoints were measured). This option is used **every time** before a fast scan will be made.

4.) ✱DIG2 = 0; disable endswitch

5.) ✱DIG 4 = 1; Slow Scan mode

6.) ✱Turn the motor to **minus direction** (- 1 step)

7.) ✱DIG2 = 1. Enable endswitch. The right endswich has to become ON

8.) If the endswitch is NOT ON: turn the motor to **minus direction** until the endswitch is pressed.

9.) ✱DIG4 = 0 (fast Scan Mode / half steps)

10.) load all registers in the "IP-Stepper_server" (R0 - R2, R4 - R7 (refer to Table 2))

11.) set the "GO" property in the "IP-Stepper_server" to 1

B. start a FAST SCAN

12.) DIG5 = 0 to enable function of DIG1 and GATE2. The stepper will start immediately, if GATE2 (coming from the timing system) switches to 1. It will run until the endswitch is pressed again by the wirescanner.

C. after FAST SCAN

13.) DIG5 = 1. This disables the movement of the stepper again

14.) DIG 3 = 1. Disable IM 1007, to pevent it for demaging because of high current

D. Signal Diagram of Fast Scan Signals

Figure 1

VI. Watchdog signal

The Wirescanner is prevented of soft and hardwareproblems with a wotchdog signal on IPdigital 24 port 23. This signal must toggle in a frequency of ~0.1 Hz. If the watchdogsignal is not available, the hardware driver will be switched off.

VII. Read Back Signals

A. read back Power Relais

Two signals are able to read back. The first one is the Relais position of ALL power Relais for IM 1007. They are OR coupled. IP Digital 24 Port 21 is responsible for this action.

B. read back Watchdog Relais

The second one is the watchdog relais contact. It has to be permanently high. If it's low, the watchdog is not working properly, or some other problems appeared.

VIII. Schematic of all components

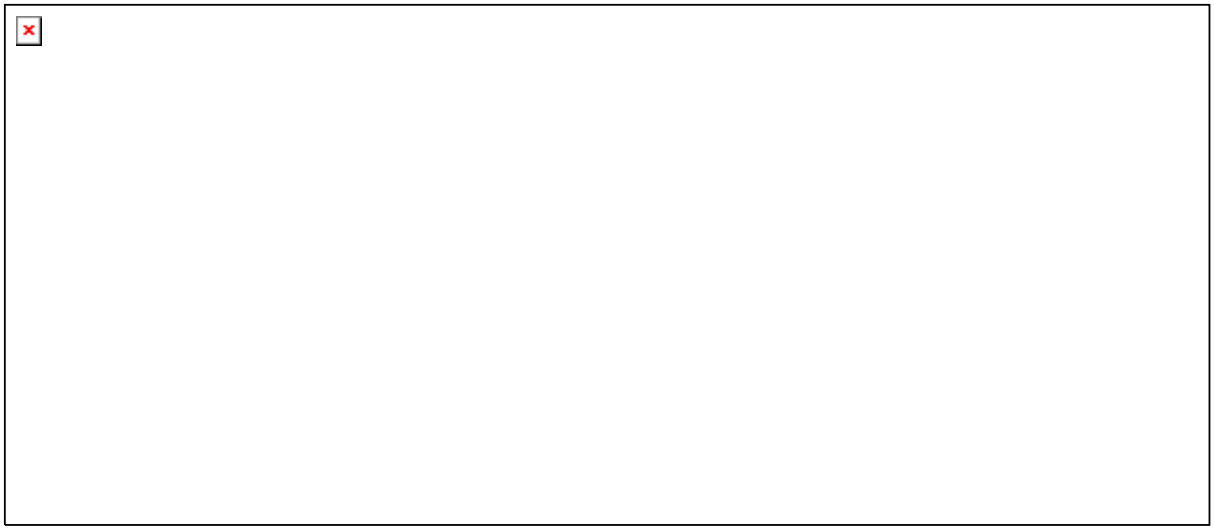

Figure 2

IX. Hardware Signal Table of the wirescanner

signal name	Source : IP-Digital 24 IO#				Assignment for
	M1	M2	M3	M4	
DIG1	0	5	10	15	1 = send Z-pulse from Heidenhain rulers to IP-Quaddrature, to reset IP-Quad. **NO** timing pulses of TIM1–4 have any effect to IP-Quad, set Interpolation of EXE612 to 10-fold 0 = send the 4 timing pulses to IP-Quad for measuring the 4 waypoints, set Interpolation of EXE612 to 5-fold (this is done because of the high speed)
DIG2	1	6	11	16	1 = enable right endswich of IP-Stepper. If motor is driving into minus direction, it will stop at the endswitch. The property “at right end” in the IP-Stepper server will come to “1”. *This is also needed for the FastScan.* 0 = disable endswitch
DIG3	2	7	12	17	1 = reset stepper motor driver IM1007 0 = normal operation
DIG4	3	8	13	18	1 = slow scan modus (256 microsteps; 51200 steps/round) 0 = fast scan modus (400 steps / round)
DIG5	4	9	14	19	1 = DIG1 and GATE 2 have no effect, the stepper starts immedately after the software start command (SLOW scan) 0 = DIG1 and GATE 2 are enabled, a hardware signal from outside starts the stepper (FAST scan)

signal name	source	Assignment for
GATE 2	Timing system	set START trigger for the IP-Stepper
TIM0 , TIM1, TIM2, TIM3	Timing system	set the actual Heidenhain counter to one of the four IP-Quad registers

hardware signals:

STEPout	IP-Stepper	Steps out to stepper driver IM1007
stepLE	IP-Stepper	right end switch is pressed (used for finding the home position), return from IP-Stepper

Table 1

X. Register Settings for IP-Stepper

soll: 400 steps				register settings IP-Stepper						
vf	tu	td	Signal *)	R0	R1	R2	R4	R5	R6	R7
1.00 m/s										
2778	0.01	0.01	ja	415	0	2778	14	14	14	488
2778	0.02	0.02	ja	428	0	2778	29	29	28	488
2778	0.03	0.03	ja	443	0	2778	43	43	42	488
2778	0.04	0.04	ja	456	0	2778	58	58	56	488
1.08 m/s										
3000	0.01	0.01	ja	415	0	3000	13	13	15	488
3000	0.02	0.02	ja	430	0	3000	27	27	30	488
3000	0.03	0.03	90%	445	0	3000	40	40	45	488
3000	0.04	0.04	ja	460	0	3000	53	53	60	488
1.12 m/s										
3100	0.01	0.01	ja	416	0	3100	13	13	16	488
3100	0.02	0.02	ja	431	0	3100	26	26	31	488
3100	0.03	0.03	90%	447	0	3100	39	39	47	488
3100	0.04	0.04	90%	462	0	3100	52	52	62	488

Table 2