AHDSP 2v1 / 2v2
Service Manual
F – 2107 / F - 2207

Printed for :	**TechnoCrane Europe**
Date :	**30/03/2009**

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1. GENERAL DESCRIPTION

AHDSP2 is a Automatic Leveling System designed for camera cranes. The main task for electronics is trace angle of the arm (sensor : incremental encoder), calculating gear and driving motor to desired position (sensor : incremental encoder). In addition used level inclinometer allow to automatic correction of level. AHDSP2 have build in advanced self tests procedures for startup and run time diagnostics.

DESCRIPTION

The AHDSP2v1 is a PCB which is a part of Automatic Leveling System. The system contents:

- AHDSP2–PCB enclosure with motor, gear and inclinometer (ref.: 10 006)
- Centre encoder (yoke encoder) (ref.: 10 001)
- Encoder cable with plugs (ref.: 10 002)
- Safe voltage cable power supply (ref.: 10 003)
- AC mains cable for power supply (ref.: 10 004)
- Power supply box (ref.: 10 005)

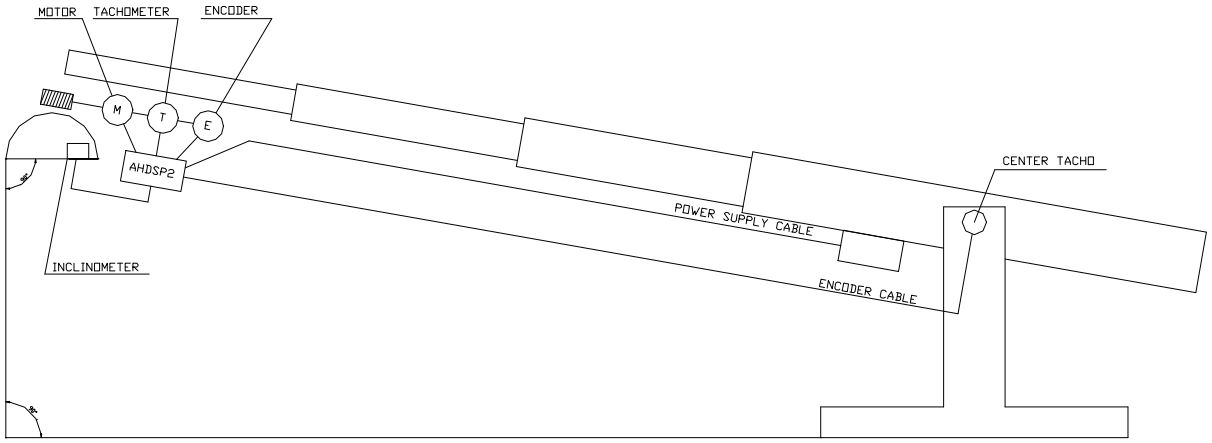


Fig.1. AHDSP2 system

FUNCTIONAL DESCRIPTION

The AHDSP2 works like electronics gear with level correction based on inclinometer.

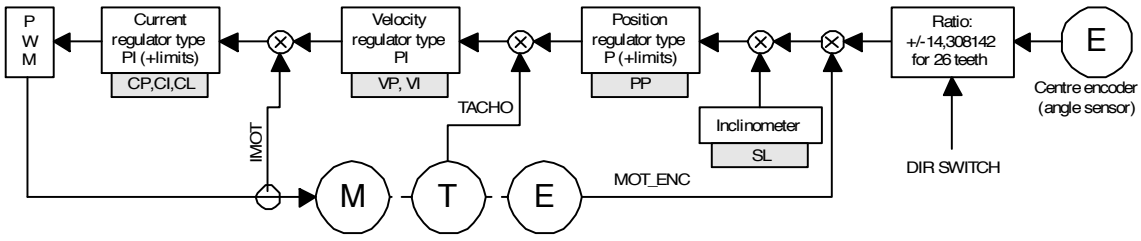


Fig.2. Functional diagram

Besides the main task of AHDSP2, the software check property work of hardware at startup time and all time at the work time (see Fig.3.)

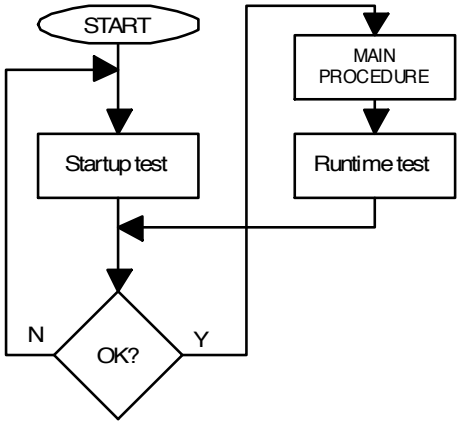


Fig.3. Test are second task of AHDSP2.

2. SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

- Operation temperature –20C to +50C (0F .. 122F), the case of AHDSP2 can have temperature 20C(36F) higher than air
- Maximum operating angle +/-102deg (from middle state)
- Maximum velocity : 60deg/sec
- Level correction from inclinometer (aprox): 1,2deg/sec for 18sec or 0,12deg/sec for infinity leveling time
- Level correction active time: aprox. 18 sec. from startup or infinite

ELECTRICAL SPECIFICATIONS

- Power supply : AHDSP2 – nominal 35VDC 8A, the range : 31V .. 39V
  Power supply box : input (100 .. 240)VAC 4A, output 35V/ 8,5A
- PWM frequency = 18,43 kHz
- Current loop bandwidth aprox. 1,5kHz
- Velocity loop bandwidth aprox. 100Hz

3.MAINTIENCE

INTERNAL ADJUSTMENTS

The adjustments are accomplish with few keys and 6 – digit LED. Arrange of keys and display is shown on fig.5.

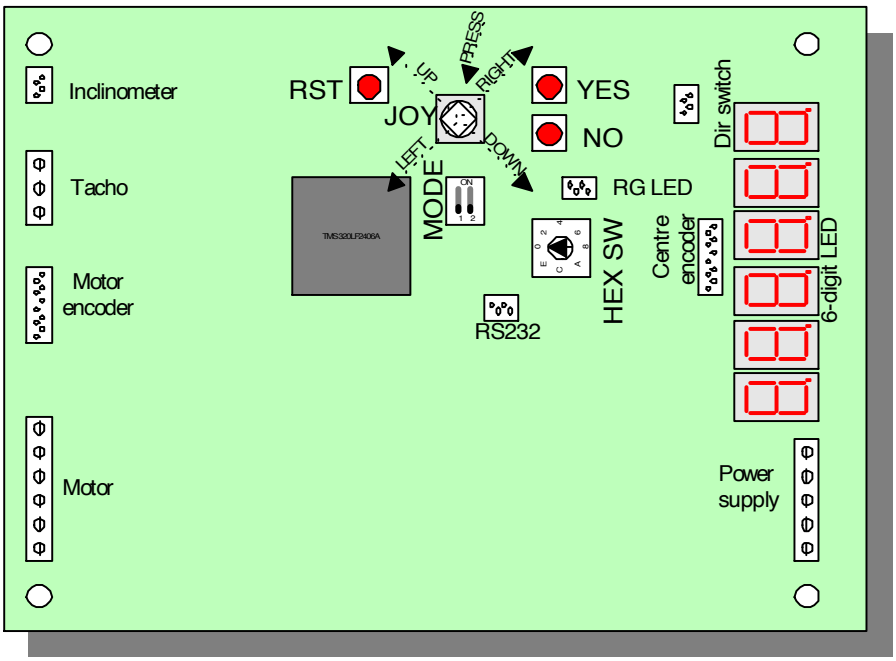


Fig.5. Display and keys arrange on PCB

The structure of key combination is shown on fig. 6.

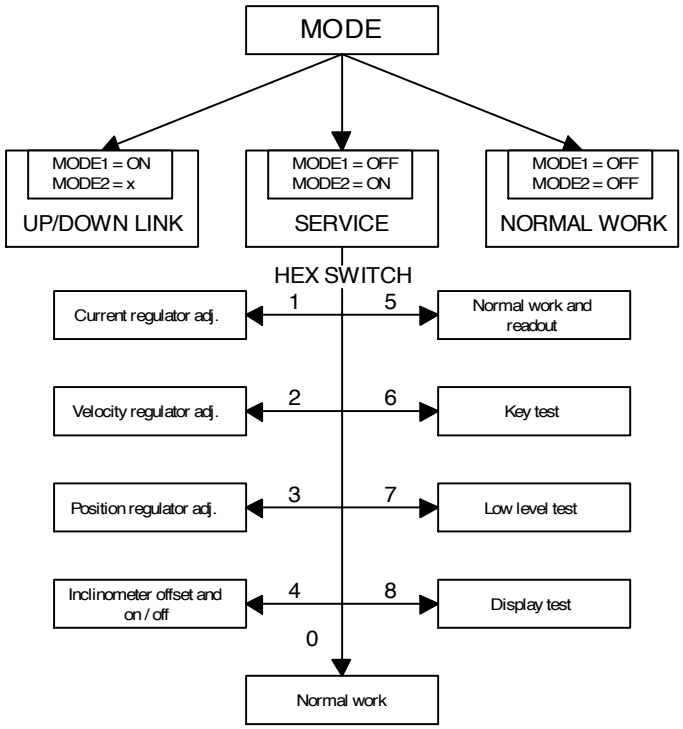


Fig.6. Display and keys arrange on PCB

CURRENT REGULATOR ADJUSTMENT

The current regulator has three parameters for adjustment:

1. CP – proportional gain
2. CI – integrate gain/time
3. CL – current limit value

For the best results use osciloscope for motor current measure (see fig.7a or 7b). Settings for osciloscope :

- Fig 7a : 0,1V/div (give 1A/div), 1ms/div, offset voltage = 0 V;
- Fig 7b : 0,2V/div (give 1,6A/div) or 0,1V/div (give 0,8A/div) 1ms/ div, offset voltage = 1,58V;

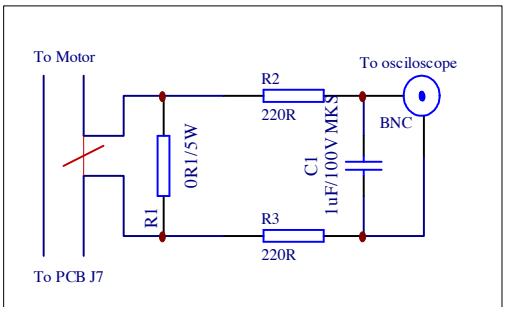


Fig.7a. Measure current motor with serial resistor

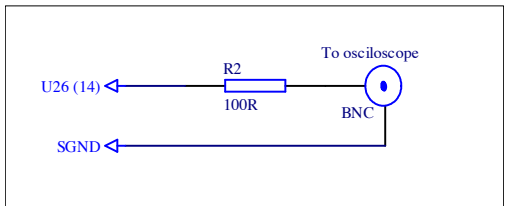


Fig.7b. Measure current motor on PC

For the best result use DC input in osciloscope (AC can cheat shape on osciloscope.

Current regulator adjustment needs steps:

STEP 1.
Setting MODE SWICH 2 in ON state – for come in service mode.

STEP 2.
Setting HEX SWITCH in 1 state – current regulator parameters access.

STEP 3.
Pushing for 1 second RST button – key state are reading after reset system.

STEP 4.
After boot, from menu is possible to selection: <CP>, <CI>, <CL> by JOY SWITCH (LEFT, RIGHT direction).

STEP 5.
Selecting CP parameter by pressing JOY SWITCH – the current ramp generator will turn on (motor current = 3A, 125Hz)

STEP 6.
Setting the best response of the current (watching on the osciloscope) by JOY SWITCH (UP, DOWN)

STEP 7.
For saving parameter value press key YES (NO for cancel)

STEP 8.
In the same way adjustment CI parameter.

The possible response are shown on fig.6. Increase value of parameters makes stiffness motor, but increase noise from the motor.

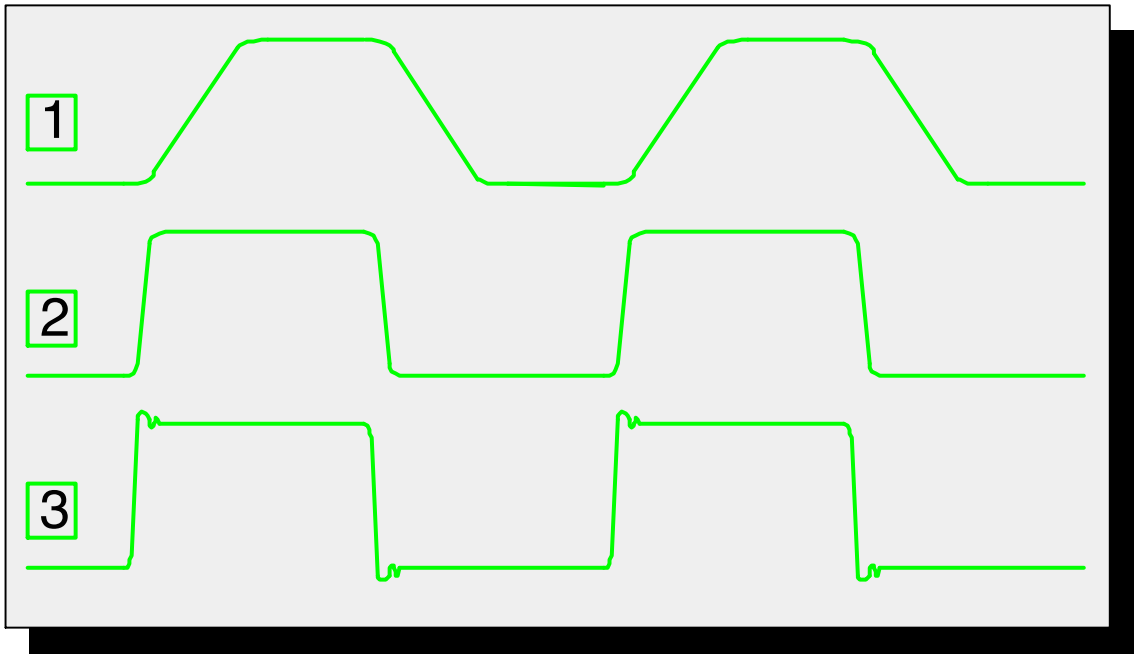


Fig.8. Current response depend by CP and CI parameter. (shape 1: gain too low, 2: gain good, 3: gain too high)

The shape present on Fig.8. can be noise by PWM frequency (18,43kHz).

Use current limit <CL> parameter for change maximum allowed motor current [0.9 to 9 A].

VELOCITY REGULATOR ADJUSTMENT

The velocity regulator has two parameters for adjustment:

4. UP – proportional gain
5. UI – integrate gain/time

For the best results use osciloscope for motor velocity measure (see fig.10a or 10b).
Settings for osciloscope for :

- Fig 10a : 0,5V/div, 20ms/div , offset voltage=0 V;
- Fig 10b : 0,1V/div or 0,05V/div 20ms/ div , offset voltage = 1,58V;

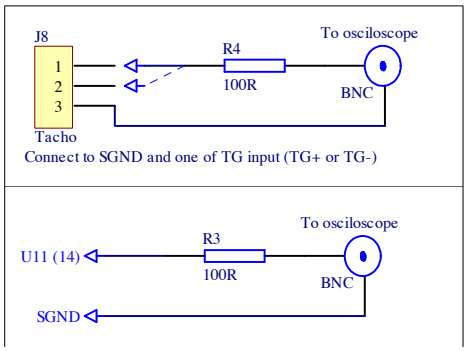


Fig.10a. Measure motor velocity direct on TG
Fig.10b. Measure motor velocity on PCB

For the best result use DC input in osciloscope (AC can cheat shape on osciloscope).

Velocity regulator adjustment needs steps:

STEP 1.
Setting MODE SWICH 2 in ON state – for come in service mode.

STEP 2.
Setting HEX SWITCH in 2 state – current regulator parameters access.

STEP 3.
Pushing for 1 second RST button – key state are reading after reset system.

STEP 4.
After boot, from menu is possible to selection: <UP >, <UI > by JOY SWITCH (LEFT, RIGHT direction).

STEP 5.
Selecting UP parameter by pressing JOY SWITCH – the velocity ramp generator will turn on (velocity = 60rpm, 10Hz)

STEP 6.
Setting the best response of the velocity (watching on the osciloscope) by JOY SWITCH (UP, DOWN)

STEP 7.
For saving parameter value press key YES (NO for cancel)

STEP 8.
In the same way adjustment UI parameter.

POSITION REGULATOR ADJUSTMENT

The position regulator has one parameter for adjustment:
6. PP – proportional gain

Position regulator adjustment needs steps:

STEP 1.
Setting MODE SWICH 2 in ON state – for come in service mode.

STEP 2.
Setting HEX SWITCH in 3 state – position regulator parameter access.

STEP 3.
Pushing for 1 second RST button – key state are reading after reset system.

STEP 4.
After boot, from menu is possible to selection only <PP >

STEP 5.
Selecting PP parameter by pressing JOY SWITCH – the position ramp generator will turn on (position = 3 deg, 2Hz)

STEP 6.
Setting the best response of the positioning by JOY SWITCH (UP, DOWN)

STEP 7.
For saving parameter value press key YES (NO for cancel)

INCLINOMETER OFFSET ADJUSTMENT

The inclinometer has two parameters for adjustment:
7. oF – inclinometer offset
8. In – inclinometer on/off

Inclinometer offset adjustment needs steps:

STEP 1.
Setting MODE SWICH 2 in ON state – for come in service mode.

STEP 2.
Setting HEX SWITCH in 4 state – inclinometer offset parameter access.

STEP 3.
Pushing for 1 second RST button – key state are reading after reset system.

STEP 4.
After boot, from menu is possible to selection <oF >, <In >

STEP 5.
Select oF parameter by pressing JOY SWITCH

STEP 6.
Setting level offset by JOY SWITCH (UP, DOWN)

STEP 7.
For saving parameter value press key YES (NO for cancel)

For turn off/on inclinometer do steps 1..4, and then :

STEP 5.
Select In parameter by pressing JOY SWITCH

STEP 6.
Set inclinometer on or off by JOY SWITCH (UP, DOWN)

STEP 7.
For saving setting value press key YES (NO for cancel)

4. DIAGNOSTICS AND TROUBLESHOOTING

FUSE AND LED INDICATORS ON PCB

LED indicators helps to find defect on PCB. Arrange of fuse and LED is shown on fig.11.

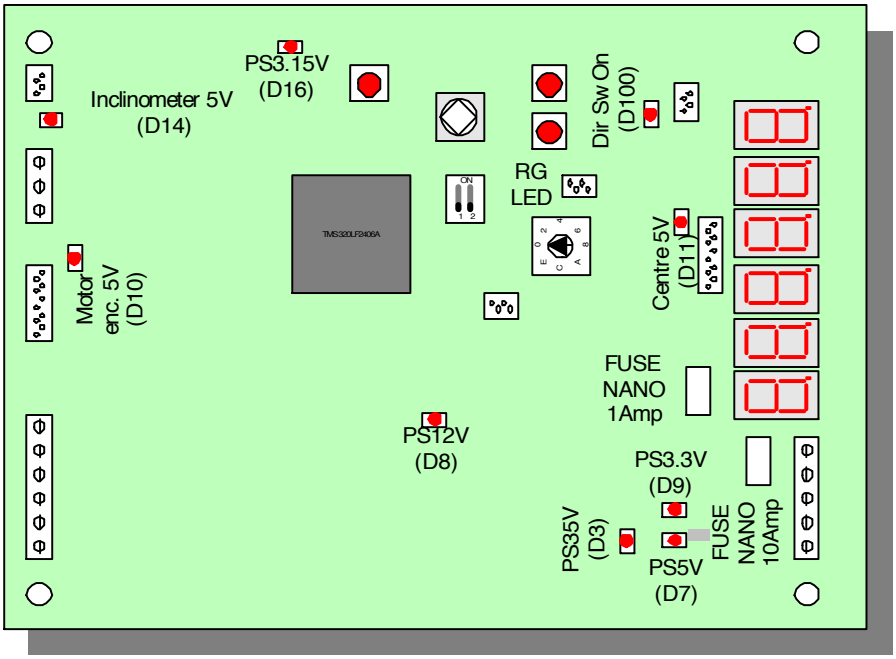


Fig.11. Fuse and LED indicators arrange on PCB

ERRORS AND WARNINGS LIST

No	What	When	Troubleshooting
Er-01	+3Verr = high state	Startup	If +3Verr is in high state it means too low ps.3.15 reference voltage (really voltage dropout ps.3.3V – ps.3.15V is high more than 0.5V, that means if ps.3.3V has correct value then the reference ps.3.15V have less than 2.7V or if ps.3.15V has correct value then ps.3.3V has more than 3.65V). Solution : check ps.3.3V, ps.3.15V if ps. Has correct value then check Q3 and R85
Er-02 Er-03 Ur-02 Ur-03	PS.+3.3V not correct	Startup, runtime	If ps.3.3V is lower than 3.2V <Ur-02> or higher than 3.4V <Ur-03> then displayed is warning and after 1.5s program continue work. If ps.3.3V is lower than 3.1V <Er-02> or higher than 3.5V <Er-03> then displayed is error and stopped program. Solution : check ps.3.3V and 3.15V if ps. Has correct value then check R106, R105 and C88
Er-04 Er-05 Ur-04 Ur-05	PS.+5.0V not correct	Startup, runtime	If ps.5.0V is lower than 4.8V <Ur-04> or higher than 5.2V <Ur-05> then displayed is warning and after 1.5s program continue work. If ps.5.0V is lower than 4.6V <Er-04> or higher than 5.4V <Er-05> then displayed is error and stopped program. Solution : check ps.5.0V and 3.15V if ps. Has correct value then check R95, R96 and C83

Er-06 Er-07 Ur-06 Ur-07	PS.+35V not correct	Startup, runtime	If ps. 35V is lower than 30V <Ur-06> or higher than 40V <Ur-07> then displayed is warning and after 1.5s program continue work. If ps.35V is lower than 26V <Er-06> or higher than 43V <Er-07> then displayed is error and stopped program. Solution : check ps.35V and 3.15V if ps. Has correct value then check R116, R117, R118, C79, C80, U20
Er-08 Er-09 Ur-08 Ur-09	PS. +12V not correct	Startup, runtime	If ps. 12V is lower than 10V <Ur-08> or higher than 14V <Ur-09> then displayed is warning and after 1.5s program continue work. If ps.12V is lower than 9V <Er-08> or higher than 15V <Er-09> then displayed is error and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check R107, R120, C89
Er-10 Er-11 Ur-10 Ur-11	Temperature value from sensor U24 not correct	Startup, runtime	If voltage at U25(1) is lower than 0.7V [-15 C] <Ur-10> or higher than 1.9V [+45 C] <Ur-11> then displayed is warning and after 1.5s program continue work. If voltage at U25(1) is lower than 0.5V[-25 C] <Er-10> or higher than 2.3V[+65 C] <Er-11> then displayed is error and stopped program. Solution : check sensor U24 (pin 1 = GND, pin 2 = +5V, pin3=10mV*Temp[C] +0.5V) and 3.15V if sensor and ps. Has correct value then check R127, C110, R128, R129, U25
Ur-12 Ur-13	Eeprom data fault	Startup	If data from eeprom is impossible to read or they are not correct then displayed is warning <Ur-12> and after 1.5s program continue work. If trial of writing default value gets still fault then displayed is warning <Ur-13> and after 1.5s program continue work. Solution : check eeprom U13, selector U14 and other SPI bus components: U12, U27
Er-14 Ur-14	Too high current Ia or too high offset	Startup	If voltage at U25(7) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-14> and after 1.5s program continue work. If voltage at U25(7) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-14> then displayed is error and stopped program. Solution : check voltage at R41 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R41 then check U26(1) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R131, R132, R133, R134, R135 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct at this stage should be: ps.+9V = min. 4.8V and ps.-9V = max. 0.2V else check U23) if output U26(1) is correct then check R130 and U25

Er-15 Ur-15	Too high current Ib or too high offset	Startup	If voltage at U25(4) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-15> and after 1.5s program continue work. If voltage at U25(4) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-15> then displayed is error and stopped program. Solution : check voltage at R42 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R42 then check U26(7) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R137, R138, R139, R140, R141 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct at this stage should be: ps.+9V = min. 4.8V and ps.-9V = max. 0.2V else check U23) if output U26(7) is correct then check R136 and U25
Er-16 Ur-16	Too high current Imot or too high offset	Startup	If voltage at U25(8) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-16> and after 1.5s program continue work. If voltage at U25(8) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-16> then displayed is error and stopped program. Solution : check voltage at R41 and at R42 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R41 and R42 then check U26(14) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R143, R144, R145, R146, R147 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct at this stage should be: ps.+9V = min. 4.8V and ps.-9V = max. 0.2V else check U23) if output U26(14) is correct then check R142, C200 and U25
Er-17 Er-18 Ur-17 Ur-18	PS. +9V not correct	Startup , runtime	First is turned on SD_CP = high signal [U19 (6) 3.3V logic], U19 translate to 5v logic to SD_CP_5 [U23(6)]. After 0.1s output of +9V is measured. If ps. +9V is lower than +8V <Ur-17> or higher than +10V <Ur-18> then displayed is warning and after 1.5s program continue work. If ps.+9V is lower than +7V <Er-17> or higher than +12V <Er-18> then is displayed error, SD_CP =low and stopped program. Solution : check ps. 3.15V if ps. Has correct value then check ps.+9V: too low voltage can be come from too high load – check U26 or can be broken down capacitors C102,C103, C104, C105, C106, C107 or U23. If error appear then ps.+9V has the same value as ps.5V then if dropout between ps.5V and ps.+9V is too high (more than 0.1V) it can be broken down U23 or U26. Check R122, R123, C108.

Er-19 Er-20 Ur-19 Ur-20	PS. –9V not correct	Startup , runtime	If ps. –9V is lower than –7,5V <Ur-19> or higher than –10V <Ur-20> then displayed is warning and after 1.5s program continue work. If ps.-9V is lower than –6,5V <Er-19> or higher than –12V <Er-20> then is displayed error, SD_CP =low and stopped program. Solution : check ps. 3.15V if ps. Has correct value then check ps.-9V: too low voltage can be come from too high load – check U26 or can be broken down capacitors C102,C103, C104, C105, C106, C107 or U23. If error appear then ps.-9V has the same value as SGND then if dropout between SGND and ps.-9V is too high (more than 0.1V) it can be broken down U23 or U26. Check R124, R125, U20
Er-21 Ur-21	Too high current Ia or too high offset after turn on power supply +/- 9V	Startup	After positive test power supply 9Vagain is measured Ia (see step 14). If voltage at U25(7) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-21> and after 1.5s program continue work. If voltage at U25(7) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-14> then displayed is error, SD_CP =low and stopped program. Solution : check voltage at R41 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R41 then check U26(1) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R131, R132, R133, R134, R135 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct) if output U26(1) is correct then check R130 and U25
Er-22 Ur-22	Too high current Ib or too high offset after turn on power supply +/- 9V	Startup	After positive test power supply 9Vagain is measured Ib (see step 15). If voltage at U25(4) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-22> and after 1.5s program continue work. If voltage at U25(4) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-22> then displayed is error, SD_CP =low and stopped program. Solution : check voltage at R42 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R42 then check U26(7) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R137, R138, R139, R140, R141 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct) if output U26(7) is correct then check R136 and U25

Er-23 Ur-23	Too high current Imot or too high offset after turn on power supply +/- 9V	Startup	After positive test power supply 9Vagain is measured Imot (see step 16). If voltage at U25(8) is higher than ½ ps.3.15V + 20mV [1.60V] then displayed is warning <Ur-23> and after 1.5s program continue work. If voltage at U25(8) is higher than ½ ps.3.15V + 40mV [1.62V] <Er-23> then displayed is error, SD_CP =low and stopped program. Solution : check voltage at R41 and at R42 (should be less than few milivolts – if is more then trouble can be in power transistors Q4 ... Q7 or driver U9) if current not flow through R41 and R42 then check U26(14) (should be ½ ps.3.15V = 1.58Vif is more than 1.60V then trouble can be in U26, R143, R144, R145, R146, R147 or too high difference between SGND and GND – check R150, other possibility is that the power supply of U26 is not correct) if output U26(14) is correct then check R142, C200 and U25
Er-24 Er-25 Ur-24 Ur-25	Incorrect motor leg MOTA voltage	Startup	In this stage voltage of leg MOTA should have value approx. PS12V + 0.8V. If MOTA is lower than 10V <Ur-24> or higher than 14V <Ur-25> then displayed is warning and after 1.5s program continue work. If MOTA is lower than 9V <Er-24> or higher than 15V <Er-25> then displayed is error, SD_CP =low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R86, R87, R88, R89, C97, C98, U20
Er-26 Er-27 Ur-26 Ur-27	Incorrect motor leg MOTB voltage	Startup	In this stage voltage of leg MOTB should have value approx. PS12V + 0.8V. If MOTB is lower than 10V <Ur-26> or higher than 14V <Ur-27> then displayed is warning and after 1.5s program continue work. If MOTB is lower than 9V <Er-26> or higher than 15V <Er-27> then displayed is error, SD_CP =low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R90, R91, R92, R93, C99, C100, U20
Er-28 Ur-28	Incorrect motor leg MOTA voltage after low DIS HIP4081 (U9)	Startup	In this stage PWM_ON = low [U19(2) 3.3Vlogic – reference SGND] translated through U19 and optocoupler OC1 to 5V logic (with reference to GND), voltage of leg MOTA should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R108/R109 make half PS.35V. If MOTA is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-28> and after 1.5s program continue work. If MOTA is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-28>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R86, R87, R88, R89, C97, C98, U20

Er-29 Ur-29	Incorrect motor leg MOTB voltage after low DIS HIP4081 (U9)	Startup	In this stage PWM_ON = low [U19(2) 3.3Vlogic – reference SGND] translated through U19 and optocoupler OC1 to 5V logic (with reference to GND), voltage of leg MOTB should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R110/R111 make half PS.35V. If MOTA is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-29> and after 1.5s program continue work. If MOTA is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-29>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R90, R91, R92, R93, C99, C100, U20
Er-30 Ur-30	Too high voltage on turned on Q5	Startup	In this stage only transistor Q5 is turned on. Voltage on Q5 should be less than few milivolts, but leg MOTA is measured trough filter, so the max. Allowed voltage is specified for measure after 2ms from turn on Q5 time. If MOTA is higher than 0.3V then displayed is warning <Ur-30> and after 1.5s program continue work. If MOTA is higher than 0.6V then displayed is error <Er-30>, Q5 is turned off, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R37, R38, R39, R40, D201, D202, D203, D204, R86, R87, R88, R89, C97, C98, U20
Er-31 Ur-31	Incorrect motor leg MOTA voltage after turn off Q5	Startup	In this stage transistor Q5 is turned off. Voltage of leg MOTA should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R108/R109 make half PS.35V. Leg MOTA voltage is measured after 2ms from turn off Q5 time. If MOTA is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-31> and after 1.5s program continue work. If MOTA is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-31>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R86, R87, R88, R89, C97, C98, U20

Er-32 Ur-32	Too high voltage on turned on Q7	Startup	In this stage only transistor Q7 is turned on. Voltage on Q7 should be less than few milivolts, but leg MOTB is measured trough filter, so the max. Allowed voltage is specified for measure after 2ms from turn on Q7 time. If MOTB is higher than 0.3V then displayed is warning <Ur-32> and after 1.5s program continue work. If MOTB is higher than 0.6V then displayed is error <Er-32>, Q7 is turned off, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R37, R38, R39, R40, D201, D202, D203, D204, R90, R91, R92, R93, C99, C100, U20
Ur-33	Disconnected motor	Startup	In this stage transistor Q7 is turned on. Voltage on leg MOTA should be the same as MOTB if motor is connected. If MOTA is higher than 0.6V then displayed is warning <Ur-32> and after 1.5s program continue work. Solution : check motor connections [J7-Motor connector]
Er-34 Ur-34	Incorrect motor leg MOTB voltage after turn off Q7	Startup	In this stage transistor Q7 is turned off. Voltage of leg MOTB should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R110/R111 make half PS.35V. Leg MOTB voltage is measured after 2ms from turn off Q7 time. If MOTB is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-34> and after 1.5s program continue work. If MOTB is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-34>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R90, R91, R92, R93, C99, C100, U20
Er-35 Ur-35	Too high voltage on turned on Q4	Startup	In this stage the Q5 is turned on for 2ms (charging C47 trough D12), then after 1ms Q4 is turn on. Measure MOTA (trough filter) is done after 2ms from turn on Q4 time. Voltage of leg MOTA should have almost PS.35V because driver is turned on, and Q4 is on . If MOTA is lower than PS35V – 0.3V then displayed is warning <Ur-35> and after 1.5s program continue work. If MOTA is lower than PS35V – 0.6V then displayed is error <Er-35>, Q5 is turn off, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R86, R87, R88, R89, C97, C98, U20

Er-36 Ur-36	Incorrect motor leg MOTA voltage after turn off Q4	Startup	In this stage transistor Q4 is turned off. Voltage of leg MOTA should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R108/R109 make half PS.35V. Leg MOTA voltage is measured after 2ms from turn off Q4 time. If MOTA is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-36> and after 1.5s program continue work. If MOTA is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-36>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R86, R87, R88, R89, C97, C98, U20
Er-37 Ur-37	Too high voltage on turned on Q6	Startup	In this stage the Q7 is turned on for 2ms (charging C48 trough D13), then after 1ms Q6 is turn on. Measure MOTB (trough filter) is done after 2ms from turn on Q7 time. Voltage of leg MOTB should have almost PS.35V because driver is turned on, and Q6 is on . If MOTB is lower than PS35V – 0.3V then displayed is warning <Ur-37> and after 1.5s program continue work. If MOTB is lower than PS35V – 0.6V then displayed is error <Er-37>, Q6 is turn off, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R90, R91, R92, R93, C99, C100, U20
Er-38 Ur-38	Incorrect motor leg MOTB voltage after turn off Q6	Startup	In this stage transistor Q6 is turned off. Voltage of leg MOTB should have approx. ½ PS.35V because driver is turned on, all mosfets are off, so divider R110/R111 make half PS.35V. Leg MOTB voltage is measured after 2ms from turn off Q6 time. If MOTB is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-38> and after 1.5s program continue work. If MOTB is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-38>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R108, R109, R110, R111, R 90, R91, R92, R93, C99, C100, U20

Er-39 Ur-39	Incorrect motor leg MOTA voltage after turn on PWM frequency 18,43kHz	Startup	In this stage PWM generator is turned on with pulse width 50%. Voltage of leg MOTA should have approx. ½ PS.35V because driver is turned on and pulse width is 50 %, so after filtering MOTA should half PS.35V. If MOTA is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-39> and after 1.5s program continue work. If MOTA is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-39>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R86, R87, R88, R89, C97, C98, U20
Er-40 Ur-40	Incorrect motor leg MOTB voltage after turn on PWM frequency 18,43kHz	Startup	In this stage PWM generator is turned on with pulse width 50%. Voltage of leg MOTB should have approx. ½ PS.35V because driver is turned on and pulse width is 50 %, so after filtering MOTB should half PS.35V. If MOTB is lower than ½ PS35V – 2V or higher than ½ PS35V + 2V then displayed is warning <Ur-40> and after 1.5s program continue work. If MOTB is lower than ½ PS35V – 4V or higher than ½ PS35V + 4V then displayed is error <Er-40>, PWM_ON = high, SD_CP = low and stopped program. Solution : check ps.12V and 3.15V if ps. Has correct value then check power transistors Q4 ... Q7, driver U9 and D12, D13, C47, C48, R41, R42, R 90, R91, R92, R93, C99, C100, U20
Ur-41	Too high +5Ve (output) voltage when Q2 is turn off	Startup	If output 5.0V is higher than 3V in turn off state then displayed is warning <Ur-41> and after 1.5s program continue work. Solution : check Q2, R10, R11, U19 and external devices connected to J2, J3 and J4.
Er-42 Ur-42	Output +5.0Ve not correct	Startup, runtime	In this stage the +5e_ON gets low [U19(5)] and the +5Ve output is on. Voltage +5Ve measure is done after 50ms. If output +5Ve voltage value is less than ps.5V – 0.5V then displayed is warning <Ur-42> and after 1.5s program continue work. If dropout is more than 0.8V then displayed is error <Er-42>, turn off +5Ve, PWM_ON = high, SD_CP = low and stopped program. Solution : check Q2, R10, R11, U19, R14, R15, R65, EF3, EF4, EF18, C19, C20, C51, C17, C18 and external devices connected to J2, J3 and J4.
Er-43 Ur-43	Output +5.0V for motor encoder not correct	Startup, runtime	In this stage the +5e_ON is low [U19(5)] and the +5Ve output is on. If output +5V for motor encoder (+5Ve1) voltage value is less than 5Ve – 0.5V then displayed is warning <Ur-43> and after 1.5s program continue work. If dropout is more than 0.8V then displayed is error <Er-43>, turn off +5Ve, PWM_ON = high, SD_CP = low and stopped program. Solution : check Q2, R10, R11, F3 and external device connected to J2.

Er-44 Ur-44	Output +5.0V for centre encoder not correct	Startup, runtime	In this stage the +5e_ON is low [U19(5)] and the +5Ve output is on. If output +5V for centre encoder (+5Ve2) voltage value is less than 5Ve – 0.5V then displayed is warning <Ur-44> and after 1.5s program continue work. If dropout is more than 0.8V then displayed is error <Er-44>, turn off +5Ve, PWM_ON = high, SD_CP = low and stopped program. Solution : check Q2, R10, R11, F4 and external device connected to J3.
Er-45 Ur-45	Output +5.0V for inclinometer not correct	Startup, runtime	In this stage the +5e_ON is low [U19(5)] and the +5Ve output is on. If output +5V for inclinometer (+5Ve3) voltage value is less than 5Ve – 0.5V then displayed is warning <Ur-45> and after 1.5s program continue work. If dropout is more than 0.8V then displayed is error <Er-45>, turn off +5Ve, PWM_ON = high, SD_CP = low and stopped program. Solution : check Q2, R10, R11, F5 and external device connected to J4.
Er-46	Motor encoder connection fault	Startup, runtime	One or more motor encoder connections missing (OE1 = high). If error then displayed <Er-46>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF5 ... EF10, R16, R17, R18, C22, C21, U4, check encoder
Er-47	Centre encoder connection fault	Startup, runtime	One or more centre encoder connections missing (OE2 = high). If error then displayed <Er-47>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF11 ... EF16, R19, R20, R21, C24, C23, U5, check encoder
Er-48	Motor encoder connection A/A fault	Startup	Connections J2(7) or / and J2(8) from motor encoder missing (AQA1 = high). If error then displayed <Er-48>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF5, EF6, R16, U4, check encoder line A/A
Er-49	Motor encoder connection B/B fault	Startup	Connections J2(5) or / and J2(6) from motor encoder missing (AQB1 = high). If error then displayed <Er-49>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF7, EF8, R17, U4, check encoder line B/B
Er-50	Centre encoder connection A/A fault	Startup	Connections J3(7) or / and J3(8) from centre encoder missing (AQA2 = high). If error then displayed <Er-50>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF11, EF12, R19, U5, check encoder line A/A
Er-51	Centre encoder connection B/B fault	Startup	Connections J2(5) or / and J2(6) from motor encoder missing (AQB2 = high). If error then displayed <Er-51>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF13, EF14, R20, U5, check encoder line B/B

Er-52	Motor encoder connection I/I fault	Startup	Connections J2(3) or / and J2(4) from motor encoder missing (AQZ1 = high). If error then displayed <Er-52>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF9, EF10, R18, U4, check encoder line I/I
Er-53	Centre encoder connection I/I fault	Startup	Connections J3(3) or / and J3(4) from centre encoder missing (AQZ2 = high). If error then displayed <Er-53>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check encoder connections and EF15, EF16, R21, U5, check encoder line I/I
Er-54 Ur-54	Too high offset from tachogenerator system measure	Startup	In this stage measured is voltage from tachogenerator. If during measurement motor will change position (checked by motor encoder) the measure is repeated. The average value of 256 measurements is stored as initial tachogenerator offset value for correction at work (zero-calibrating). If offset is higher than 16mV then displayed is warning <Ur-54> and after 1.5s program continue work. If offset is higher than 60mV then displayed is error <Er-54>, turn off +5Ve, PWM_ON = high, SD_CP= low and stopped program. Solution : check voltage from tachogenerator J8(1) and J8(2), check R50 ... R64, C56 ... C68, U11, U12, U14, U27, ps.3.15V

SERVICE MODES

AHDSP2v1 has eight service mode which are available in MODE SWICH 2 in ON state :

0. **Normal operation** – works like in no-service mode
1. **Current regulator adjustment** – described in chapter 3
2. **Velocity regulator adjustment** – described in chapter 3
3. **Position regulator adjustment** – described in chapter 3
4. **Inclinometer settings** – described in chapter 3
5. **Normal operation + readout** - use for checking value of power supply voltage, temperature, motor voltage and current, etc.
6. **Key test** – use for on PCB key test
7. **Low level tests** – use for PWM checking , +5V output, +/-9V charge pump
8. **Display test** – use for display test

GENERAL CONSIDERATION ABOUT DISPLAYING

Value on display in most causes has two letter parameter shortcut and max. Four digits of value. The negative value is displayed with all comma on after adequate comma, eg. <##1,2,3,4,> = - 1,234, <##12,3,4> = - 12,34. If value is bigger than +/-9999 then is displayed with comma on end <##9999,> .

POSSIBLE READOUTS IN SERVICE MODE 5

- <CE....> - displays centre encoder counter value
- <ME....> - displays motor encoder counter value
- <In....> - displays inclinometer voltage value
- <Sd-nor> or <Sd-rEu> - direction switch state
- <tE....> - displays temperature value
- <MA....> - displays motor leg A voltage value (refer to GND)
- <Mb....> - displays motor leg B voltage value (refer to GND)
- <MU....> - displays motor voltage value
- <MC....> - displays motor current value
- <CA....> - displays current leg A value (In some cases display incorect value)

- <Cb....> - displays current leg B value (In some cases display incorect value)
- <A3....> - displays +3.3V power supply value
- <A5....> - displays +5.0V power supply value
- <A2....> - displays +12V power supply value
- <A9....> - displays +9V power supply value
- <A8....> - displays –9V power supply value
- <PS....> - displays +35Vpower supply value
- <5E....> - displays +5Ve output power supply value
- <1E....> - displays +5Ve1 output power supply value for motor encoder
- <2E....> - displays +5Ve2 output power supply value for centre encoder
- <3E....> - displays +5Ve3 output power supply value for inclinometer
- <tA....> - displays tachogenerator voltage value
- <M.C....> - displays max. Motor current value (positiv)
- <MC.....> - displays max. Motor current value (negativ)
- <M.U....> - displays max. Motor voltage value (positiv)
- <MU.....> - displays max. Motor voltage value (negativ)
- <t.A....> - displays max. Tachogenerator voltage value (positiv)
- <tA.....> - displays max. Tachogenerator voltage value (negativ)

Button YES resets all max. Values to zero.

POSSIBLE TESTS IN SERVICE MODE 7

- 5E – Off/On - +5Ve turn off / turn on
- 9U – Off/On +/-9V turn off / turn on
- P1 – Off/On/18.4 turn off / turn on / 18.4kHz square wave
- P2 – Off/On/18.4 turn off / turn on / 18.4kHz square wave
- P3 – Off/On/18.4 turn off / turn on / 18.4kHz square wave
- P4 – Off/On/18.4 turn off / turn on / 18.4kHz square wave
- Pd – Off/On turn off / turn on
- L – Off/On/rEd/GrE/ turn off / turn on / red on / green on

Button YES for on/off or on/18.4/off option, button NO for 18.4/off

SETTINGS

In this chapter are written default (eeprom fault) and prefered values of parameters.

DEFAULT SETTINGS FOR F2107

CP = 2200
CI = 2200
CL = 7800
VP = 7500
VI = 5000
PP = 3000

PREFERED SETTINGS FOR F2107

CP = 2200
CI = 2200
CL = 9000
VP = 7500
VI = 5000
PP = 4500

DEFAULT SETTINGS FOR F2207

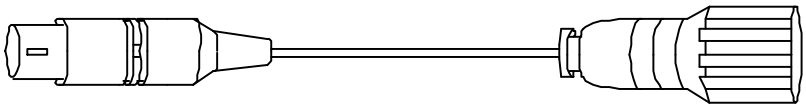
- CP = 2200
- CI = 2200
- CL = 7800
- VP = 3500
- VI = 2500
- PP = 3000

PREFERED SETTINGS FOR F2107

- CP = 2200
- CI = 2200
- CL = 9000
- VP = 3500
- VI = 2500
- PP = 4500

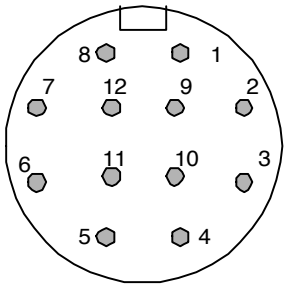
5. DIAGRAMS

ENCODER CABLE

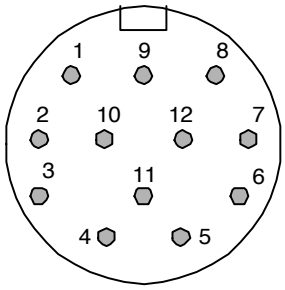


LEMO 12 pole
1. brown - pos.A - CONIN 5
2. green - neg.A - CONIN 6
3. brown/grren - + 5V - CONIN 12
4. ashen - pos. B - CONIN 8
5. pink - neg. B - CONIN 1
6. screen - screen - CONIN 9
7. white/green - GND - CONIN 10
8. red - pos. N - CONIN 3
9. black - neg. N - CONIN 4
10. white - NC. - CONIN 11
11. violet - alarm - CONIN 7
12. blue - SenseVcc - CONIN 2

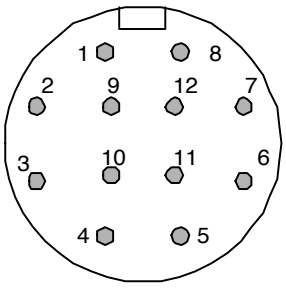
CONIN 12 pole
1. pink - neg. B - Lemo 5
2. blue - SenseVcc - Lemo 12
3. red - pos. N - Lemo 8
4. black - neg. N - Lemo 9
5. brown - pos. A - Lemo 1
6. green - neg. A - Lemo 2
7. violet - alarm - Lemo 11
8. ashen - pos. B - Lemo 4
9. screen - screen - Lemo 6
10. white/green - GND - Lemo 7
11. white - NC - Lemo 10
12. brown/green - + 5V - Lemo 3



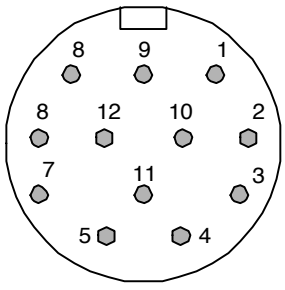
LEMO PLUG FRONT VIEW



CONIN PLUG FRONT VIEW



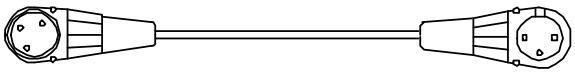
LEMO PLUG SOLDER SIDE



CONIN PLUG SOLDER SIDE

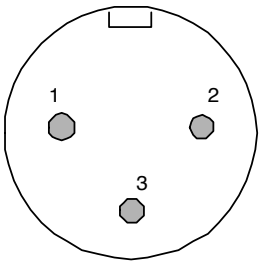
Fig.12. Encoder cable connections

SAFE VOLTAGE POWER SUPPLY CABLE

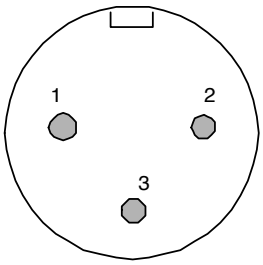


NEUTRIK 3MRC-BAG3 pole
1. Power supply 35V plus (+).
2. Power supply 35V minus (-).
3. Screen

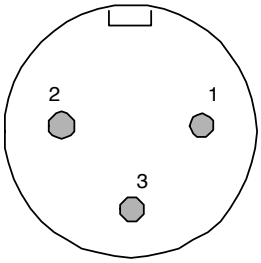
NEUTRIK 3FRC-BAG3 pole
1. Power supply 35V plus (+).
2. Power supply 35V minus (-).
3. Screen



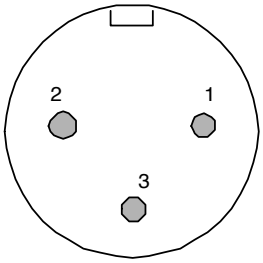
NEUTRIK 3MRC-BAG3 PLUG
FRONT VIEW



NEUTRIK 3FRC-BAG3 PLUG
FRONT VIEW



NEUTRIK 3MRC-BAG3 PLUG
SOLDER SIDE



NEUTRIK 3FRC-BAG3 PLUG
SOLDER SIDE

0Fig.13. 35V cable connections

PCB JUNCTIONS ARRANGE

The junction arrange is shown on fig.14.

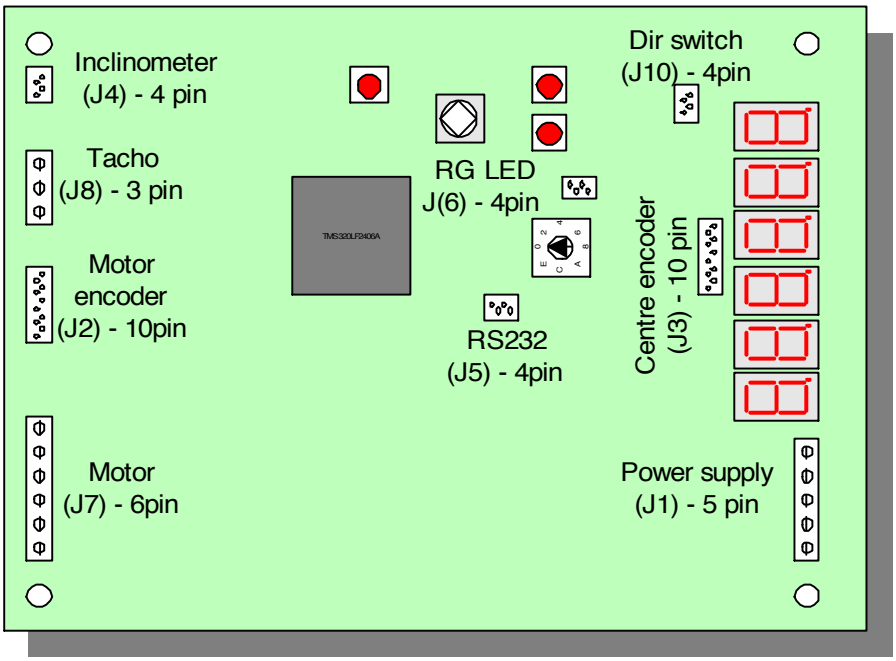


Fig.14. Arrange of junctions on PCB

Junction J1 – 35V/9A Power supply :

1. + 35V input
2. + 35V input
3. Screen
4. 0V input
5. 0V input

Junction J2 – Motor encoder RS422 (5V) connector :

1. 0V
2. 0V
3. index channel (negative) $\overline{\text{IN}}$
4. index channel (positive) IN
5. quadrature $\overline{\text{B}}$ channel (negative)
6. quadrature B channel (p)
7. quadrature $\overline{\text{A}}$ channel (negative)
8. quadrature A channel (positive)
9. + 5V power supply for encoder (max. 250mA)
10. connected with pin 9 (+5V)

Junction J3 – Centre encoder RS422 (5V) connector :

1. 0V
2. 0V
3. index channel (negative) $\overline{\text{IN}}$
4. index channel (positive) IN
5. quadrature $\overline{\text{B}}$ channel (negative)
6. quadrature B channel (positive)
7. quadrature $\overline{\text{A}}$ channel (negative)
8. quadrature A channel (positive)
9. + 5V power supply for encoder (max. 250mA)
10. connected with pin 9 (+5V)

Junction J4 – inclinometer connector (5V):
1. 0V
2. inclinometer input (-)
3. inclinometer input (+)
4. +5V power supply for inclinometer (max. 250mA)

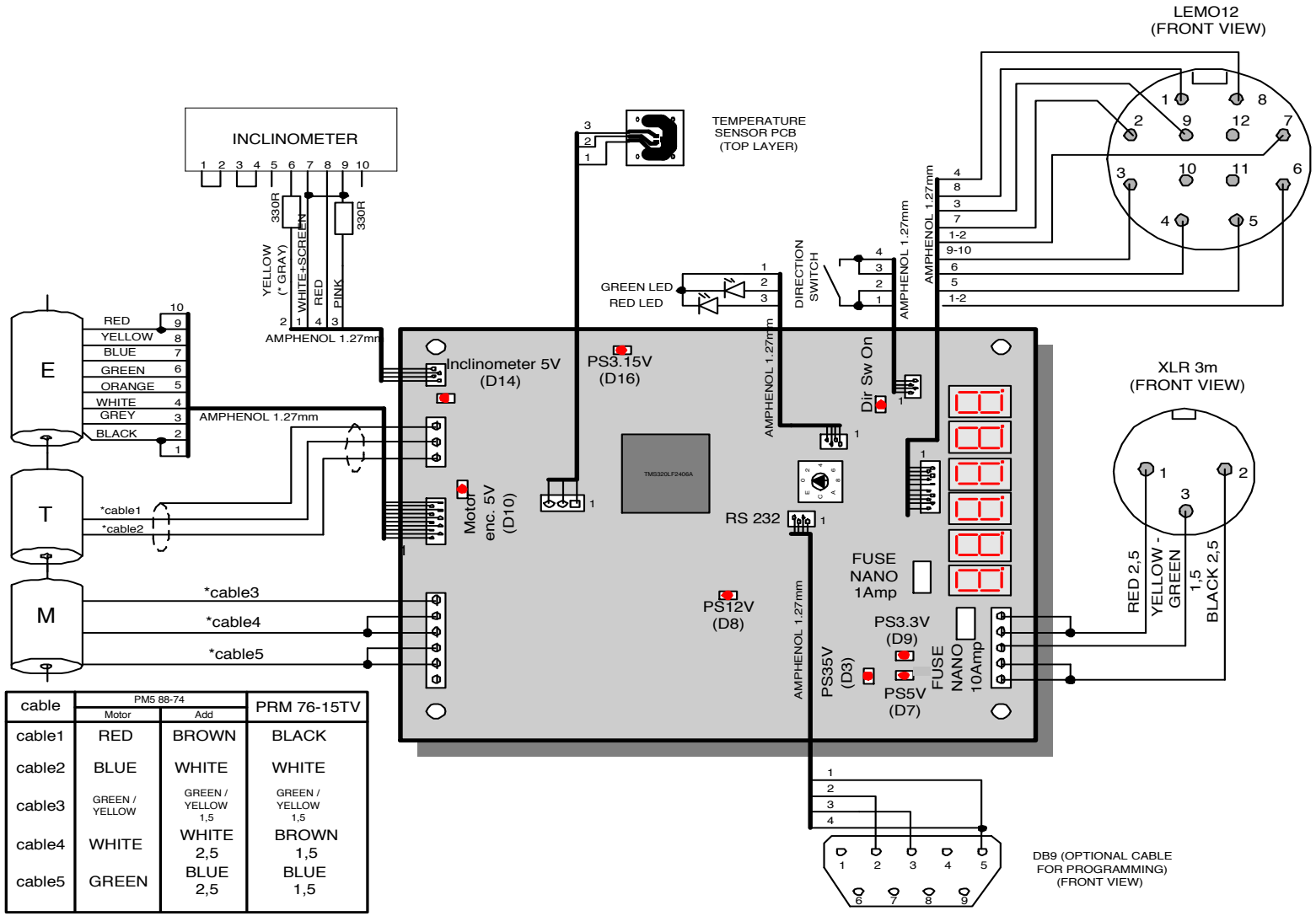
Junction J5 – RS232 connector :
1. GND
2. RXD
3. TXD
4. GND

Junction J6 – Red/Green Led connector :
1. Kathode
2. Green anode
3. Red anode

Junction J7 – Motor connector:
1. Screen
2. MOTA (MOT+)
3. MOTA (MOT+)
4. MOTB (MOT-)
5. MOTB (MOT-)
6. Screen

Junction J8 – Tachogenerator input connector :
1. TG +
2. TG –
3. Screen

Junction J10 – Direction switch connector (open 3V, closed 15mA):
1. SW –
2. SW –
3. SW +
4. SW +

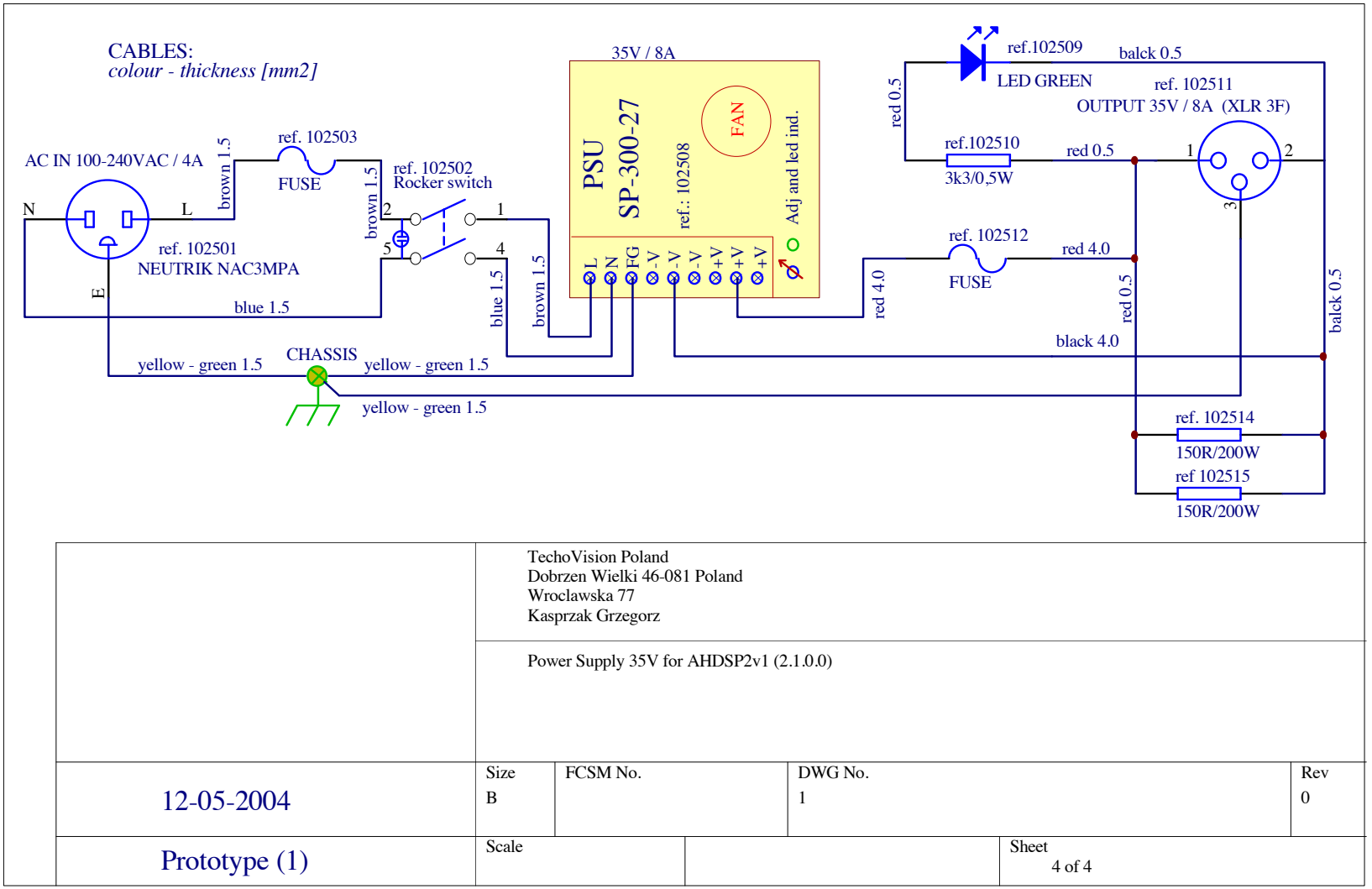


cable	PM5 88-74 Motor	PM5 88-74 Add	PRM 76-15TV
cable1	RED	BROWN	BLACK
cable2	BLUE	WHITE	WHITE
cable3	GREEN / YELLOW	GREEN / YELLOW 1,5	GREEN / YELLOW 1,5
cable4	WHITE	WHITE 2,5	BROWN 1,5
cable5	GREEN	BLUE 2,5	BLUE 1,5

AHDSP2 WIRING DIAGRAM

Fig.16. Wiring diagram for AHDSP2

POWER SUPPLY WIRING DIAGRAM



	TechoVision Poland Dobrzen Wielki 46-081 Poland Wroclawska 77 Kasprzak Grzegorz			
	Power Supply 35V for AHDSP2v1 (2.1.0.0)			
12-05-2004	Size B	FCSM No.	DWG No. 1	Rev 0
Prototype (1)	Scale		Sheet 4 of 4	

Fig.16. Power supply for AHDSP2v1