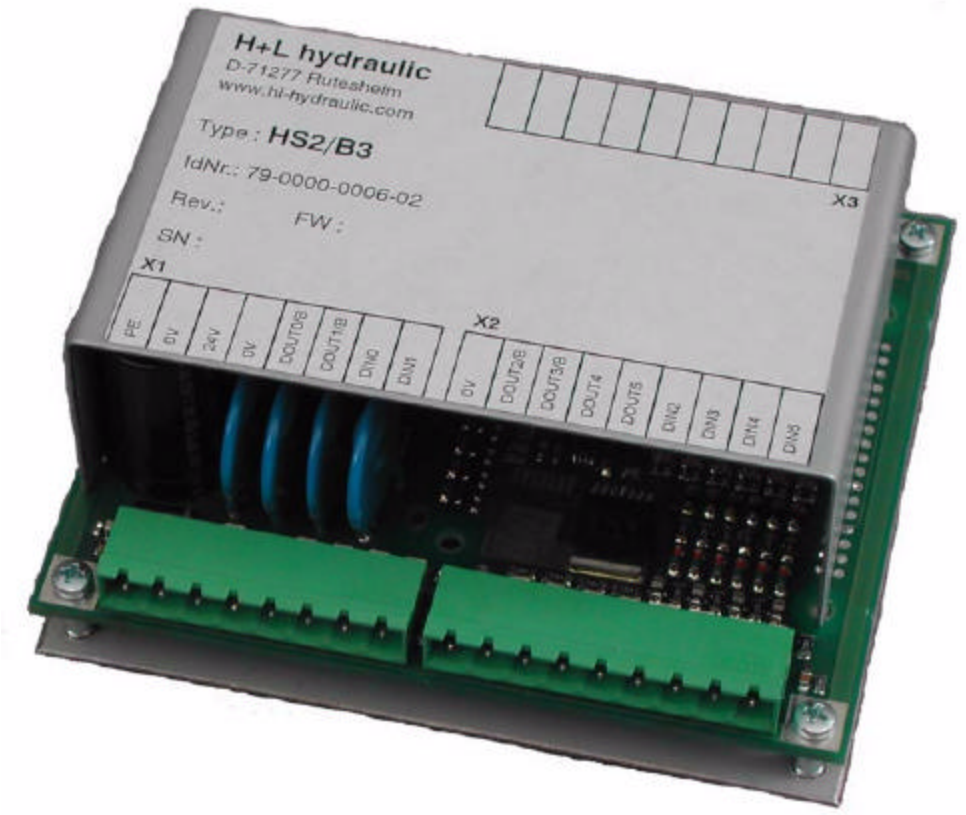
HS2/F1/HKE/HSE/ECO

Operating Instructions

- **Optimum Control for Punching Unit HKE, HSE oder ECO**
- **Cycle Time: 0,2 ms**
- **Fast valve switching by „Boosting“**
- **Mounts on 35 mm DIN Rail**
- **Data Interface: RS-232 (Option)**
- **Input/Output Status Indication on LED**
- **Ident.-No.: 79-0000-0007-20 - for HKE / HSE / ECO**



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Contents

1. General Information

- o The intended application of the device is described in this document and must be observed. Contact manufacturer / supplier for different applications.

- o Installation, configuration and operation of the device must be under supervision of a skilled electrician. National regulations must be observed for:

  - Prevention of accidents
  - Electromagnetic compliance

- o Please note the technical data of the device, environmental requirements and requirements for power supply.

- o ESD rules must be complied with when handling the device.

- o The device ist to be regarded as a „component“ in terms of EMC regulations. Use appropriate measures for shielding / filtering to fulfill EMC requirements for the machine.

- o The process of development and verification for software and firmware (sw/fw) is carried out with the necessary care and understanding. However, sw/fw can not be guaranteed to be error free. H+L reserves the right to change and correct the affected products at its own judgement.

2. Revisions

Revisions of this document:

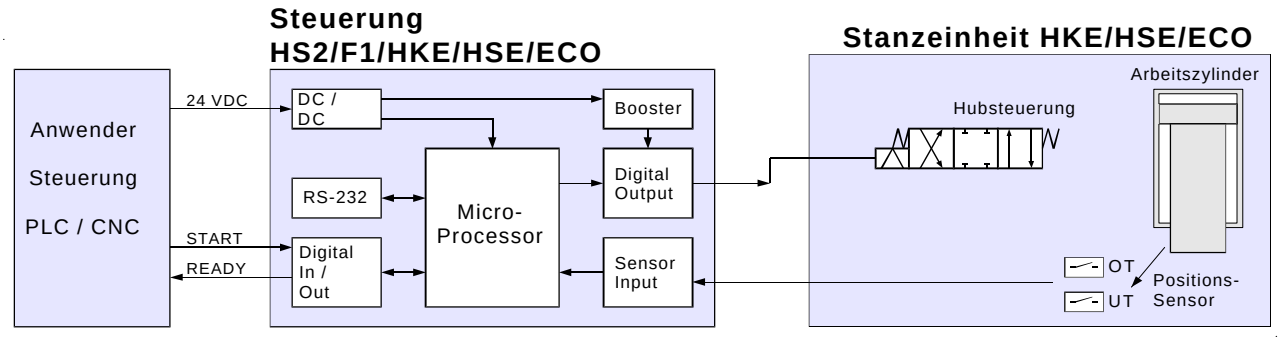
18.11.03/Bra from 79-0000-0007-20-man2de

3. Overview

The device HS2/F1/HKE/HSE/ECO (called HS2 in this document) is used to control H+L punching systems like HSE, HKE and ECO. All specific processes of the hydraulics are defined in the firmware of HS2. Thus, the user control (CNC / PLC) does not need to implement these processes. The benefits of this approach are:

- o The user saves the effort (time / money) to implement the punching control flow.
- o The critical task of punching control is offloaded from the user CNC. HS2 is running at 0,2 ms / cycle !
- o The hydraulics is used in an optimum way - all optimisations are implemented in the HS2 firmware.
- o By using the boost outputs of HS2, valve switching is much faster than with standard PLC outputs (approx. 7 ms compared to 17 ms).

Integration of the punching system into the user machine is very simple. The following diagram shows the system structure from the CNC / PLC view.



4. Scope of Delivery and Accessories

4.1 Scope of Delivery

The scope of delivery contains: the device HS2/F1/HKE/HSE/ECO
The scope of delivery does not contain: external connectors, this manual.

4.2 Accessories

The device HS2 is to be mounted to a 35 mm DIN rail in the electronics cabinet. To connect the necessary supply and I/Os, the following plugs are needed (not in the scope of delivery):

For X1:	Type: MSTB2,5/**8**-ST-5,08	Phoenix No.: 17 57 07 7	1 piece
For X2:	Type: MSTB2,5/**9**-ST-5,08	Phoenix No.: 17 57 08 0	1 piece
For X3:	Type: MSTB2,5/**10**-ST-5,08	Phoenix No.: 17 57 09 3	1 piece

Manuf.: Phoenix Contact, D-32825 Blomberg, fon: +49-5235-3-00, www.phoenixcontact.com

On request:: Item: Plug Set HS2/F1
IdNo.: 79-0041-0008-00
Contents: 1 * MSTB2,5/8-ST-5,08 1 * MSTB2,5/9-ST-5,08 1 * MSTB2,5/10-ST-5,08

5. Installation

Setup all connections, as shown in the logic diagram (addendum). Meet the following requirements for the wire diameter:

Valves:	up to 10 m: min 0,5 mm²
	up to 20 m: min 0,75 mm²
Position-Sensor:	min 0,25 mm², shielded cable, connect shield with PE in electronics cabinet
Supply:	up to 1 m from DC supply: min 1 mm²
	up to 2 m from DC supply: min 1,5 mm²
Control lines:	up to 2 m: min 0,25 mm²
RS-232:	up to 3 m: min 0,25 mm², shielded cable, connect shield with PE in electronics cabinet
Ground (PE):	max. 0,2 m to earth point, 1 mm²

Please note: all I/O for HS2 is DC coupled. Take care to have a low impedance connection on the 0V rail for the HS2 as well as for your CNC/PLC. This is also important for the RS-232 interface. If you expierience connection problems, you might need an additional RS-232 coupler with opto-isolation (very seldom).

Please note the specifications for the power supply in the technical data.

Note: using a DC power supply with „hard“ control characteristic (electronic current limiter) can result in erroneous voltage drops due to peak current limiting. Using a DC power supply with „soft“ control characteristic is preferred.

Please also note: document no. 79-0039-0019-00 and chapter „Diagnosis“.

6. Operation

6.1 General Information

The HS2 is activated with the signal RUN. With RUN=0 the device can be reset. All outputs and internal data will be cleared. For normal operation, RUN must be high.

HS2 will autonomously control all processes like punching, forming etc. The status codes in chapter 5.2 are valid for all different hydraulic systems.

Depending of the hydraulic version, the correct mode of Operation must be selected. This selection is made on rotary switch SW1. This switch has 16 positions named „1“ .. „F“ .See mechanical drawing in Chapter 8.1 to identify switch SW1.

Mode 2: HSE/HKE with electrical UT control
Mode 0: HSE/HKE with mechanical UT control
Mode 3: ECO

The operation with HSE, ECO and HKE will be described in separate chapters. For one version of hydraulic, you need only to read one specific chapter.

For HSE/HKE with electrical UT control: --> chapter 6.3

For HSE/HKE with mechanical UT control: --> chapter 6.4

For ECO: --> chapter 6.5

6.2 Status Codes

The status codes will be output on the digital outputs SCODE[1,0], READY and NOERR.

SCODE[1,0]	READY	NOERR	Status	meaning
00	1	1	READY	HS2 ist ready for START
00	0	1	STARTED	Cylinder still in OT
01	0	1	CYC_DN	Cylinder has left OT
11	0	1	CYC_UT	Cylinder has reached UT
10	0	1	CYC_UP	Cylinder has left UT
00	0	0	ERR_STA	Error: Cylinder didn't leave OT
01	0	0	ERR_DN	Cyl. has left OT , but not reached UT
11	0	0	ERR_UT	Cyl. has reached UT, but did not leave it again.
10	0	0	ERR_UP	Cy. has left UT, but not reached OT

In an error state, a low-high transition on Run will clear the state and restart the HS2.

6.3 HSE/HKE electrical UT

6.3.1 HSE/HKE electrical UT: Mode of Operation

The rotary switch must be set to position „2“.

OT (upper deadpoint) is controlled mechanically through the copy valve.
UT (lower deadpoint) is controlled electrically through a proxy switch monitoring tha ram.

6.3.2 HSE/HKE electrical UT: Position Sensors

HSE uses two proxy switches: one for OT (upper dead point) and an other one for UT (lower dead point).

The UT proxy must alway be mounted externally. In case of a HSE with a main valve size 10, the OT proxy is mountet on the main valve. For other main valve sizes (6 and 25), the OT proxy must also be mounted externally to direclty monitor the ram position.

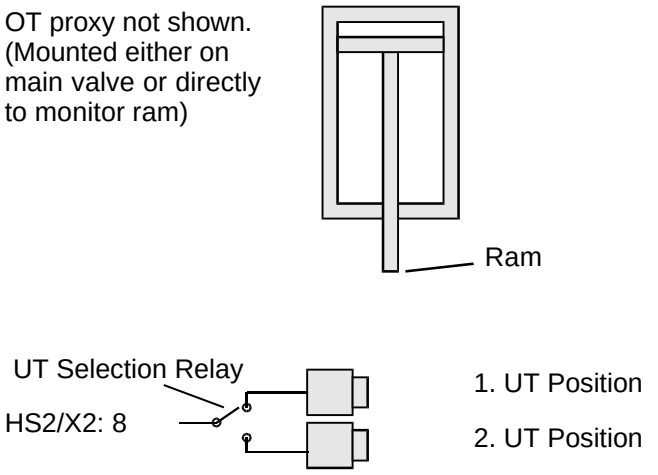
OT and UT proxies must be connected to the HS2 according to the electrical schematic.

6.3.2.1 HSE/HKE electrical UT: Programmable Position for UT

The OT position of the stroke is fixed by the copy valve.Even if there is an external proxy for OT, this one must always be mounted to the position defined by the copy valve.

If it is desired to have a programmable stroke length, this can be accomplished by using more than one proxy switch for UT. A relay that is switched under control of the PLC can be used to route the appropriate UT signal to the HS2 controller.

The following schematic shows a simple setup with two sensors for UT:



6.3.3 HSE/HKE electrical UT: Axis Position

The unit HSE/HKE uses proximity switches for UT and OT. The axis position can not be read as a digital number value. You can use the status codes (digital signals SCODE[1,0]) to monitor the ram position.

6.3.4 HSE/HKE electrical UT: Machine Cycles

The following gives the description of different machine cycles. After power-up or an error condition, an init cycle must be conducted. After that, working cycles like punching or forming can be started.

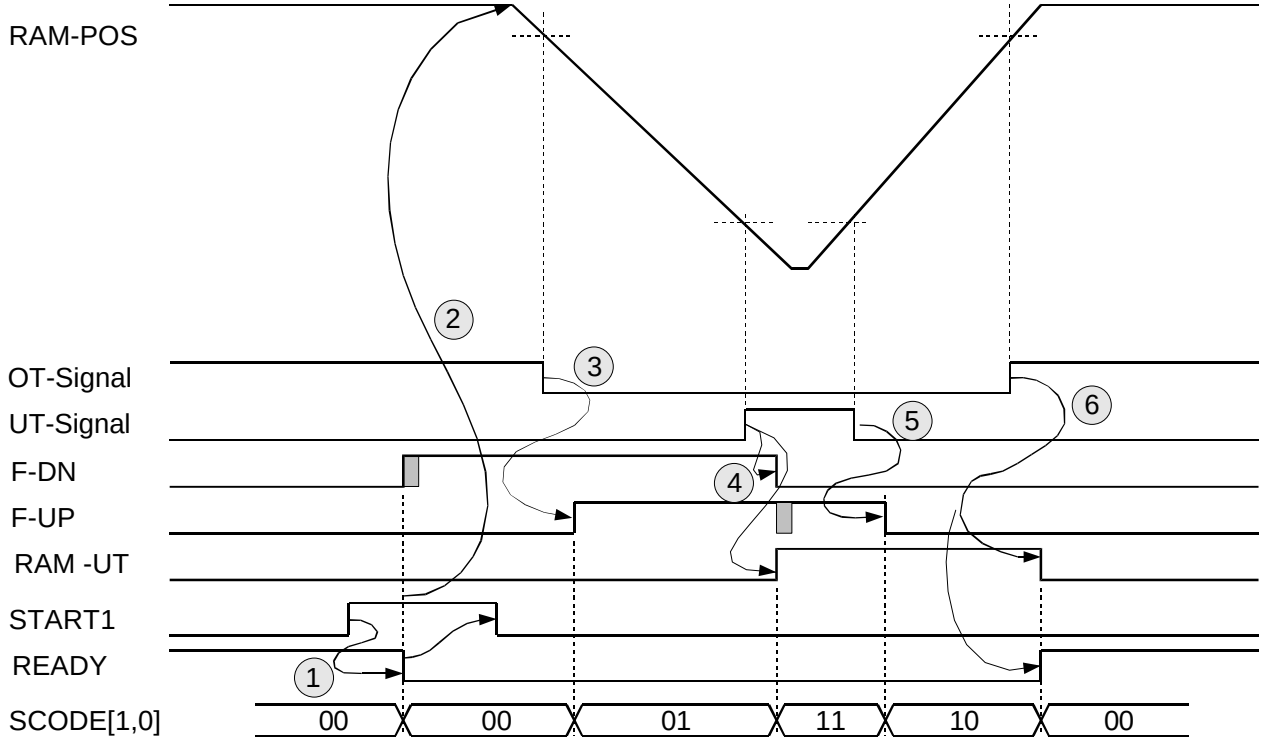
6.3.4.1 HSE/HKE electrical UT: Init Cycle

After power-up or in case of an error, the init cycle must be started. After power-on, give RUN (0-1).

The system will now be ready to start a cycle. To enable the starting via START1 or START2, the signal STEN (**ST**art **En**able) must be high. When the gating function of STEN is not needed, it can be hard wired to 24V.

6.3.4.2 HSE/HKE electrical UT: Punching

Signal START1 gives the command PUNCH. See the following flow chart for punching with HSE:

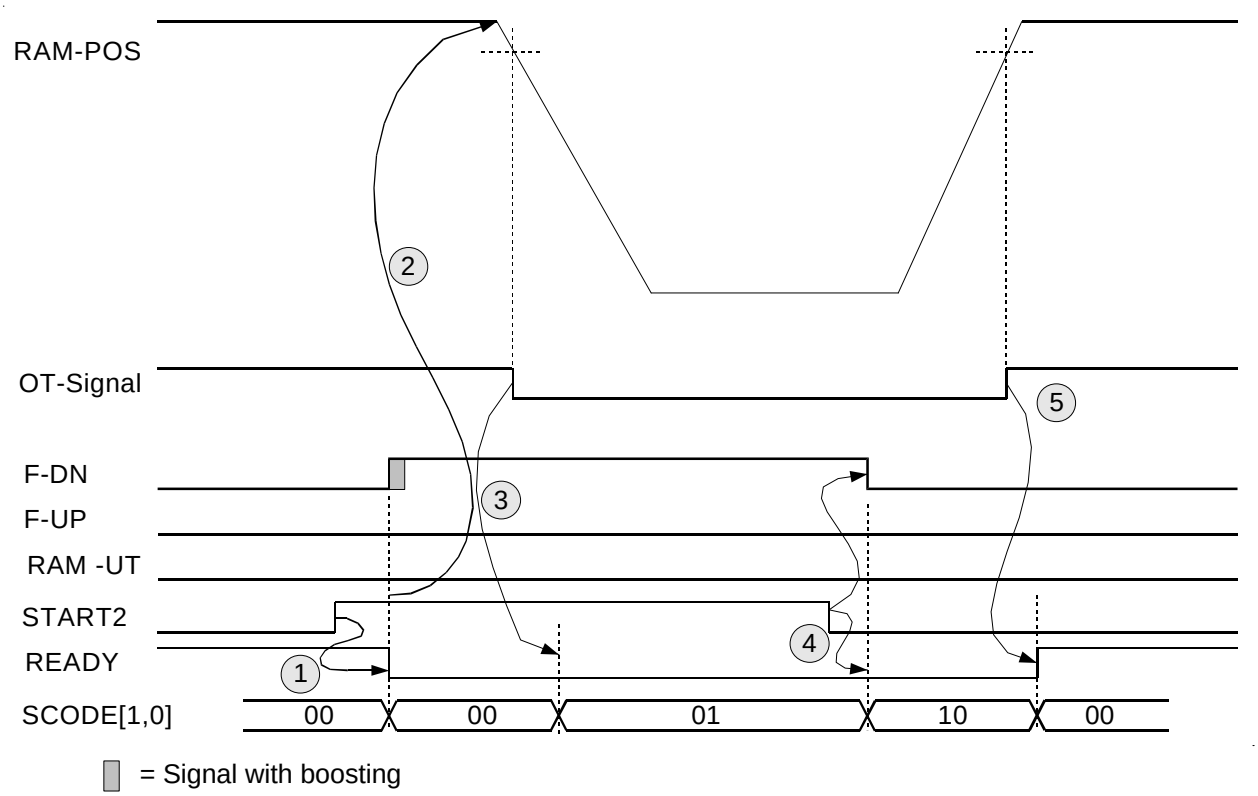


▯ = Signal with boosting

RAM-POS is the pos/time trace of the punch axis. This signal is not available, it is shown only for better understanding.

6.3.4.3 HSE/HKE electrical UT: Forming

Signal START2 gives the command PUNCH. See the following flow chart for forming with HSE:



6.4 HSE/HKE mechanical UT

6.4.1 HSE/HKE mechanical UT: Mode of Operation

The rotary switch must be set to position „0“.

OT (upper deadpoint) is controlled mechanically through the copy valve.
UT (lower deadpoint) is controlled mechanically through the copy valve.

6.4.2 HSE/HKE mechanical UT: Position Sensors

HKE uses two proxy switches: one for OT (upper dead point) and an other one for UT (lower dead point).

Both proxies are mounted to the HKL unit. OT proxy is mounted on the copy valve, UT proxy is mounted on the piloting valve size 04.

OT and UT proxies must be connected to the HS2 according to the electrical schematic.

6.4.2.1 HSE/HKE mechanical UT: Programmable Position for OT and UT

The upper stop position (OT) and lower stop position (UT) are defined by the setup of the mechanical feedback system. Since the stroke length is defined by the difference between OT and UT, it will also be predefined by the mechanical setup.

If OT and UT need to be programmable under PLC control, there is a solution for electro-pneumatic adjustment of the mechanical setup. The thwo proxy switches fo OT and UT will remain unchanged for this solution.

6.4.3 HSE/HKE mechanical UT: Axis Position

The unit HKE use proximity switches for UT and OT. The axis position can not be read as a digital number value. You can use the status codes (digital signals SCODE[1,0]) to monitor the ram position.

6.4.4 HSE/HKE mechanical UT: Machine Cycles

The following gives the description of different machine cycles. After power-up or an error condition, an init cycle must be conducted. After that, working cycles like punching or forming can be started.

6.4.4.1 HSE/HKE mechanical UT: Init Cycle

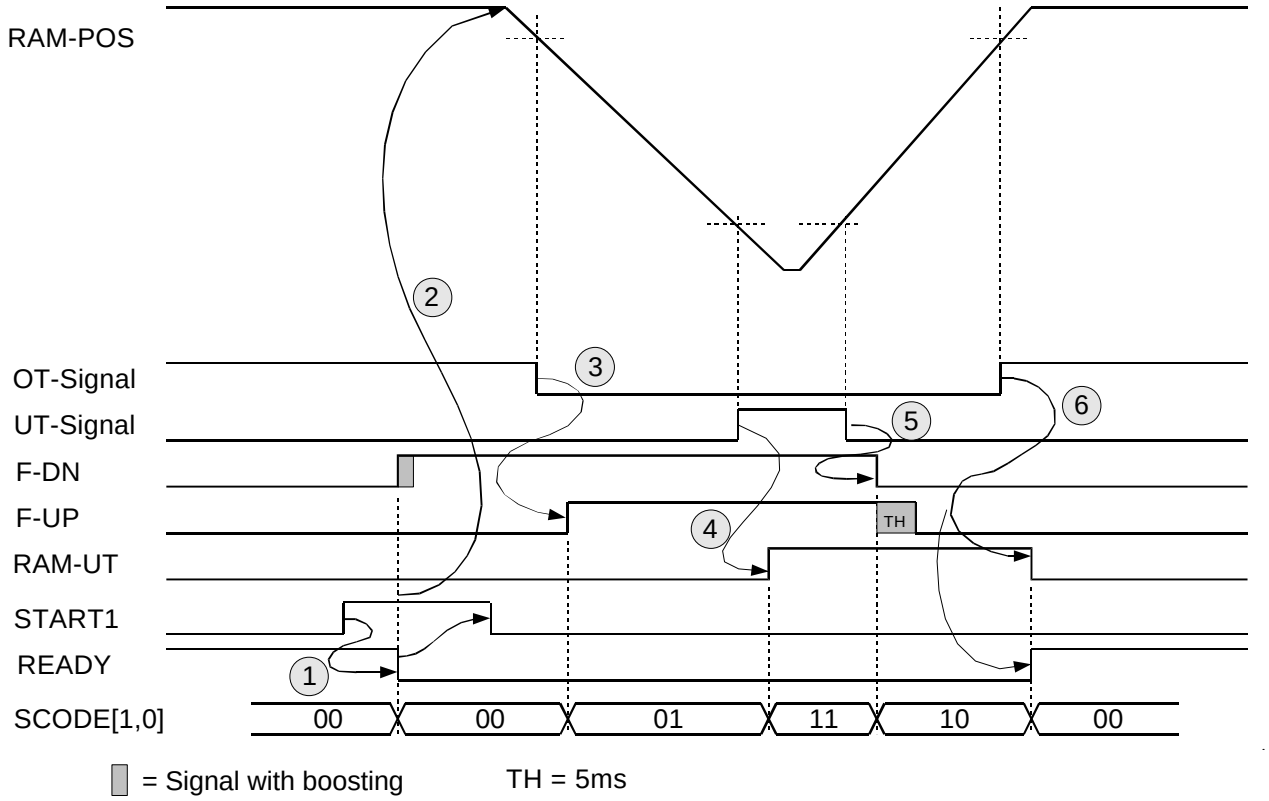
After power-up or in case of an error, the init cycle must be started. After power-on, give RUN (0-1).

The ram will be commanded into the top position (OT), until the OT proxy switch gives a signal. If the signal OT gives a 1 level, the HS2 will output the READY=1 signal.

The system will now be ready to start a cycle. To enable the starting via START1 or START2, the signal STEN (**ST**art **En**able) must be high. When the gating function of STEN is not needed, it can be hard wired to 24V.

6.4.4.2 HSE/HKE mechanical UT: Punching

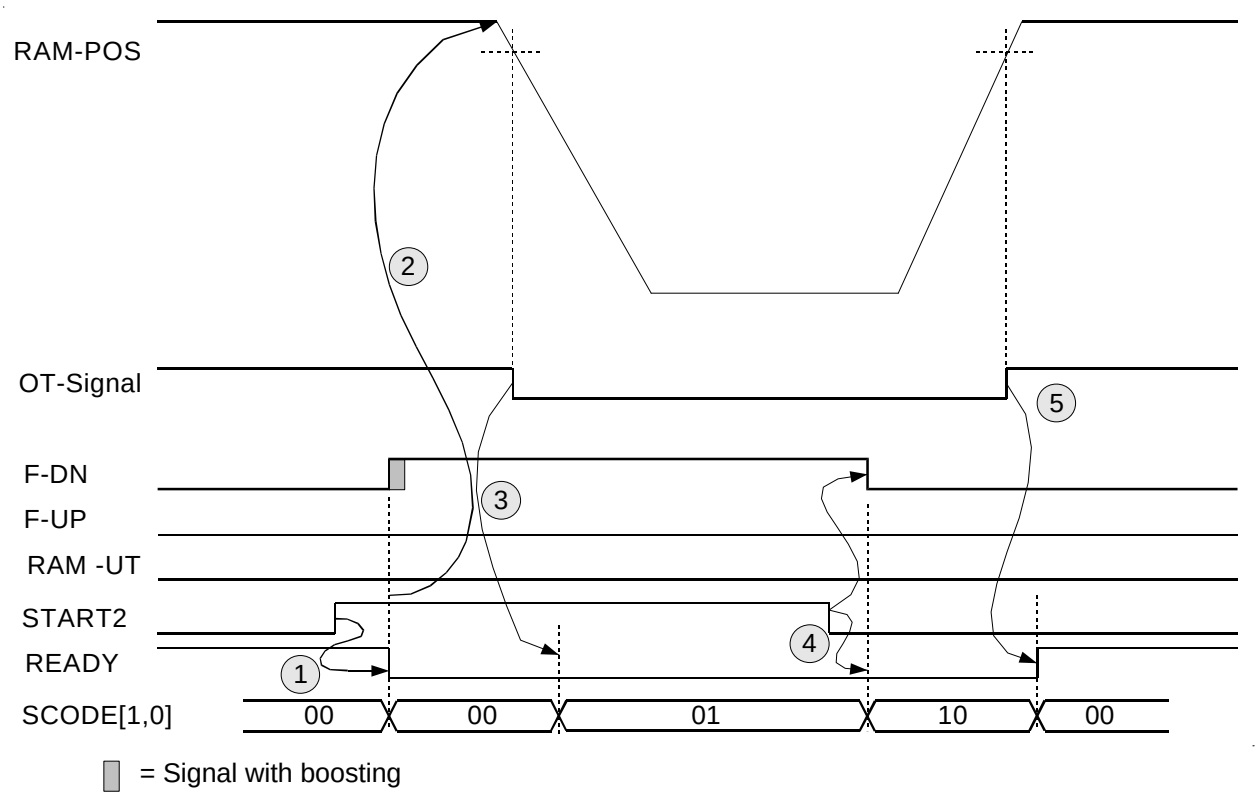
Signal START1 gives the command PUNCH. See the following flow chart for punching with HKE:



RAM-POS is the pos/time trace of the punch axis. This signal is not available, it is shown only for better understanding.

6.4.4.3 HSE/HKE mechanical UT: Forming

Signal START2 gives the command PUNCH. See the following flow chart for forming with HKE:



Notice: with active mechanical UT control, it is not possible to execute the forming cycle. Do do so, the mechanical feedback in UT most be physically de-activated.

6.5 ECO

6.5.1 ECO: Mode of Operation

The rotary switch must be set to position „3“.

OT (upper deadpoint) is controlled electrically through a proxy switch monitoring tha ram.
UT (lower deadpoint) is controlled electrically through a proxy switch monitoring tha ram.

6.5.2 ECO: Position Sensors

ECO uses two proxy switches: one for OT (upper dead point) and an other one for UT (lower dead point).

Both proxies must be mounted to directly monitor the ram position. The machine manufacturer must make the design for the correct proxy positions.

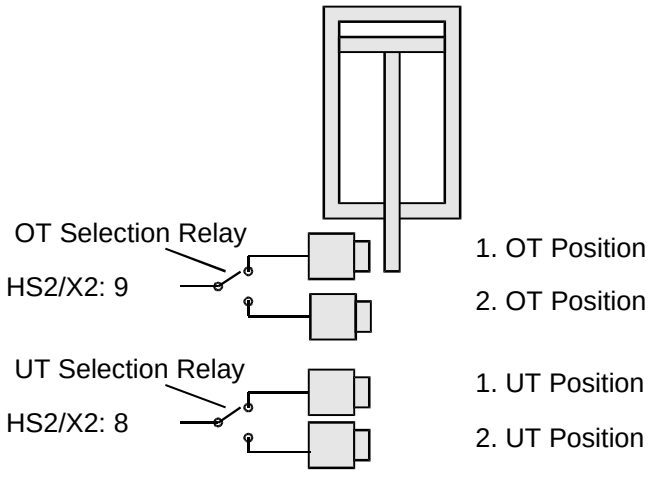
OT and UT proxies must be connected to the HS2 according to the electrical schematic.

6.5.2.1 ECO: Programmable Position for OT and UT

The cycling of the cylinder is steered by the HS2 between OT and OT. These positions are defined by the mounting position of the OT and UT proxy. Depending on the application, it may be desirable to have these positions under flexibel control. For OT, this might be one position for tool change and an other one as the start position during normal punching. For UT, different stroke lengths might be requested.

OT and UT can be programmable, when there is a set of proxies installed for UT and UT. The position of a single proxy decides for a selectable set point. Depending on the required position, the signal of a given proxy can be routed to the HS2. This can be done with a multiplexer or simple relays.

The following schematic shows a simple setup with two sensors for OT and UT:



6.5.3 ECO: Axis Position

The unit ECO use proximity switches for UT and OT. The axis position can not be read as a digital number value.

6.5.4 ECO: Machine Cycles

The following gives the description of different machine cycles. After power-up or an error condition, an init cycle must be conducted. After that, working cycles like punching or forming can be started.

6.5.4.1 ECO: Init Cycle

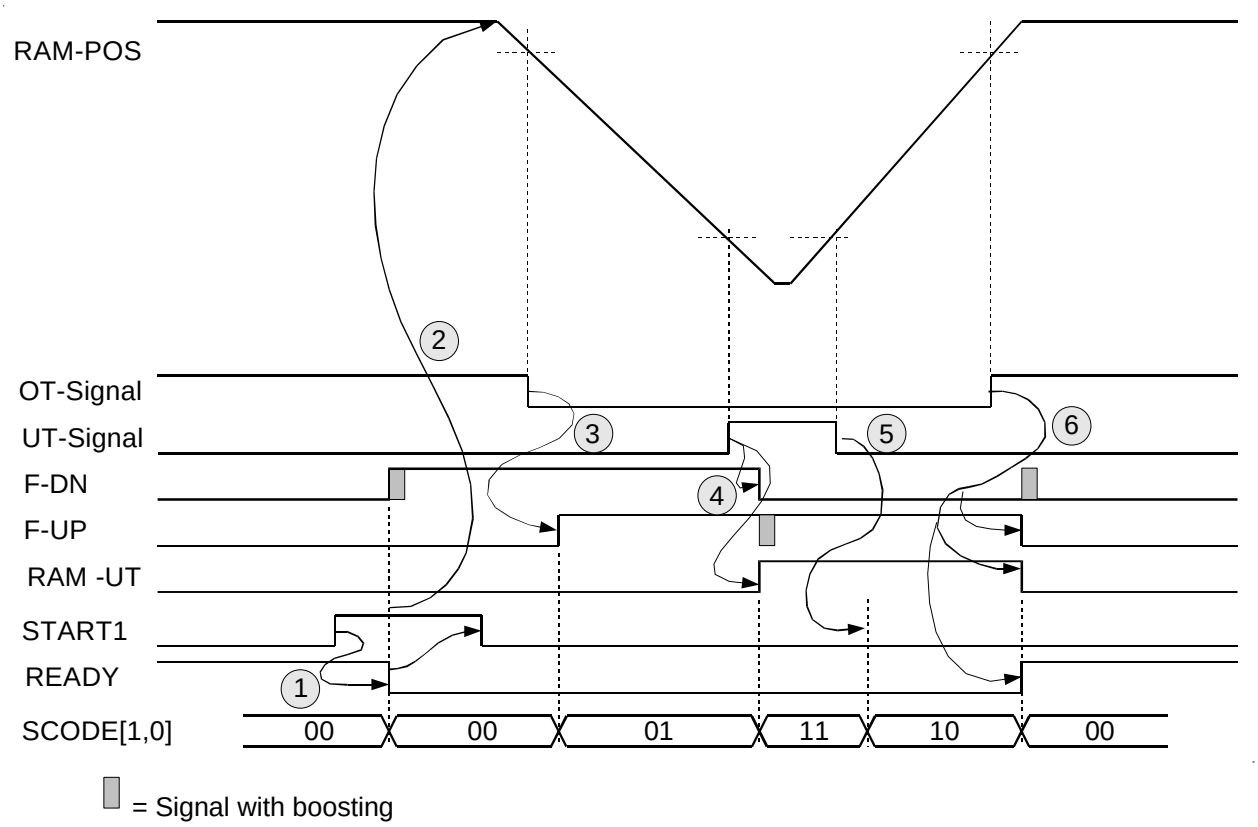
After power-up or in case of an error, the init cycle must be started. After power-on, give RUN (0-1).

The ram will be commanded into the top position (OT), until the OT proxy switch gives a signal. If the signal OT gives a 1 level, the HS2 will output the READY=1 signal.

The system will now be ready to start a cycle. To enable the starting via START1 or START2, the signal STEN (**ST**art **En**able) must be high. When the gating function of STEN is not needed, it can be hard wired to 24V.

6.5.4.2 ECO: Punching

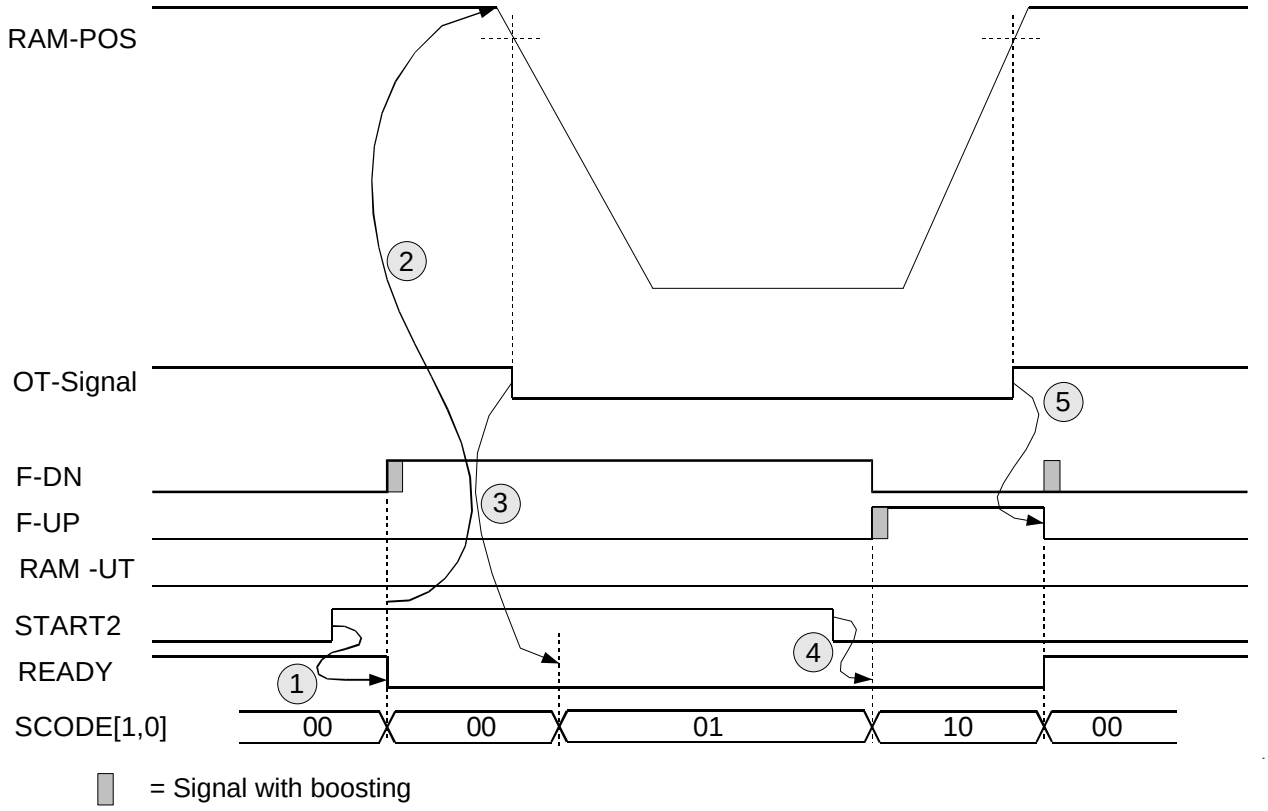
Signal START1 gives the command PUNCH. See the following flow chart for punching with ECO:



RAM-POS is the pos/time trace of the punch axis. This signal is not available, it is shown only for better understanding.

6.5.4.3 ECO: Forming

Signal START2 gives the command PUNCH. See the following flow chart for forming with ECO:



Notice: during this cycle, a substantial amount of oil heating will occur. Use this cycle only for setup and testing. For machine application, consult H+L.

7. Signals and Pin Assignments

Throughout this document, all signals are referred to with the given mnemonic.

Connector types: see chapter „Accessories“.

Connector X1

Pin	Signal	Mnemonic	Function
X1-1	PE	**PE**	Protective earth
X1-2	0V	**0V**	0V supply
X1-3	24V	**24V**	24 V supply
X1-4	0V	**0V**	Back connection for outputs F-DN and F-UP (Valve connection)
X1-5	DOUT0/B	**F-DN**	Valve output: start cycle (move down)
X1-6	DOUT1/B	**F-UP**	Valve output: terminate cycle (move up)
X1-7	DIN0	**RUN**	Control input: run
X1-8	DIN1	**STEN**	Control input: STart ENable, must be high to enable START1/2

Connector X2

Pin	Signal	Mnemonic	Function
X2-1	0V	**-**	reserved
X2-2	DOUT2/B	**-**	reserved
X2-3	DOUT3/B	**-**	reserved
X2-4	DOUT4	**SCODE0**	Status Code Bit 0
X2-5	DOUT5	**SCODE1**	Status Code Bit 1
X2-6	DIN2	**START1**	Control input: PUNCH cycle
X2-7	DIN3	**START2**	Control input: FORM cycle
X2-8	DIN4	**UT**	Sensor input: UT Sensor
X2-9	DIN5	**OT**	Sensor input: OT Sensor

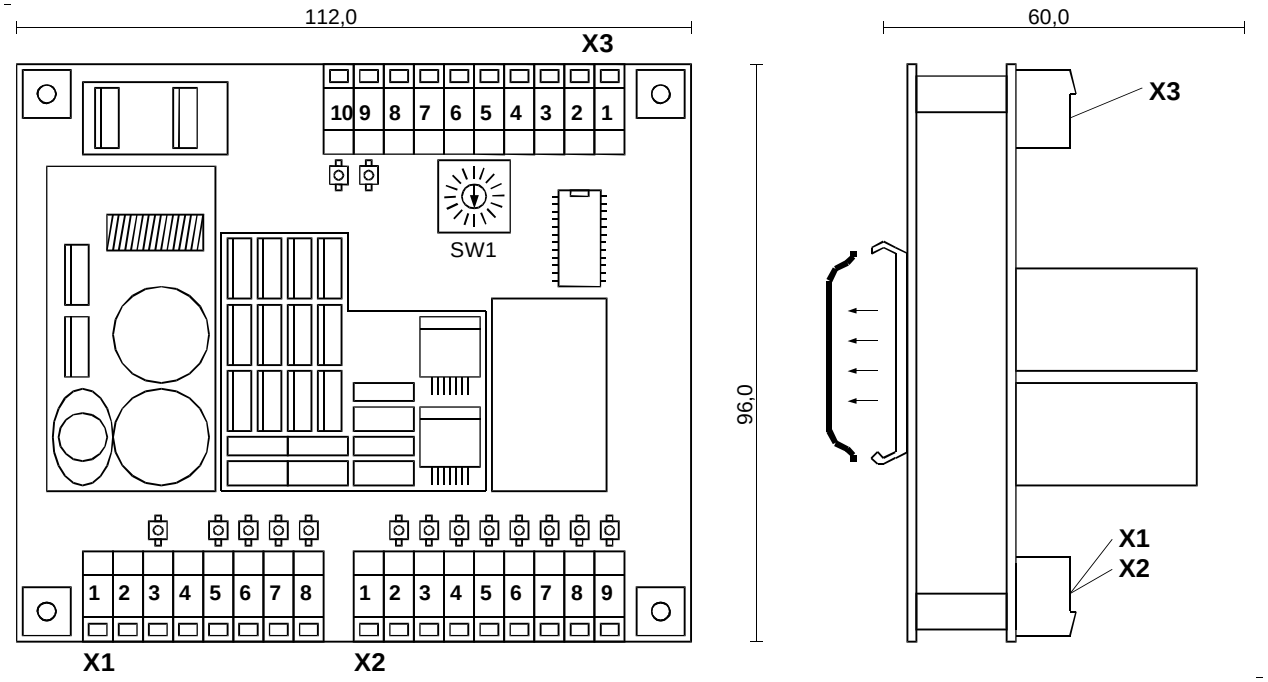
Connector X3

Pin	Signal	Mnemonic	Function
X3-1	0V/AIN0	**-**	reserved
X3-2	AIN0	**-**	reserved
X2-3	10V/AIN0	**-**	reserved
X3-4	AIN1	**-**	reserved
X3-5	AIN2	**-**	reserved
X3-6	0V/COM	**-**	reserved
X3-7	TXD	**-**	reserved
X3-8	RXD	**-**	reserved
X3-9	DOUT6	**READY**	Status output: HS2 is ready
X3-10	DOUT7	**NOERR**	Status output: HS2 is running without error

8. Technical Data

Device	HS1/F1/HKE/HSE/ECO
Ident.-No.	79-0000-0007-20
Size	approx. 112 mm * 96 mm * 60 mm Device mounts on 35 mm DIN rail
Protection	IP 00, device has metal cover against coarse contacts
Power consumption	Max. 100 VA
Storage conditions	-25°C..+70°C Humidity: 5%..95% not condesing
Operating conditions	5°C .. 50°C Humidity: 5%..95% not condesing
Power supply	21..28VDC, incuding max. 2 Vss ripple Power-On current peak: max. 10 A / 10 ms
Fuse	External: 6,3 A slow
Connections	COMBICON RM 5,08
24 V logic inputs	24V/10 mA, low = 0..5 V, high = 15 V .. Vb
24 V logic outputs	24V/50 mA
Analog input	-
Analog output	-

8.1 Dimensions



Reserved to change.

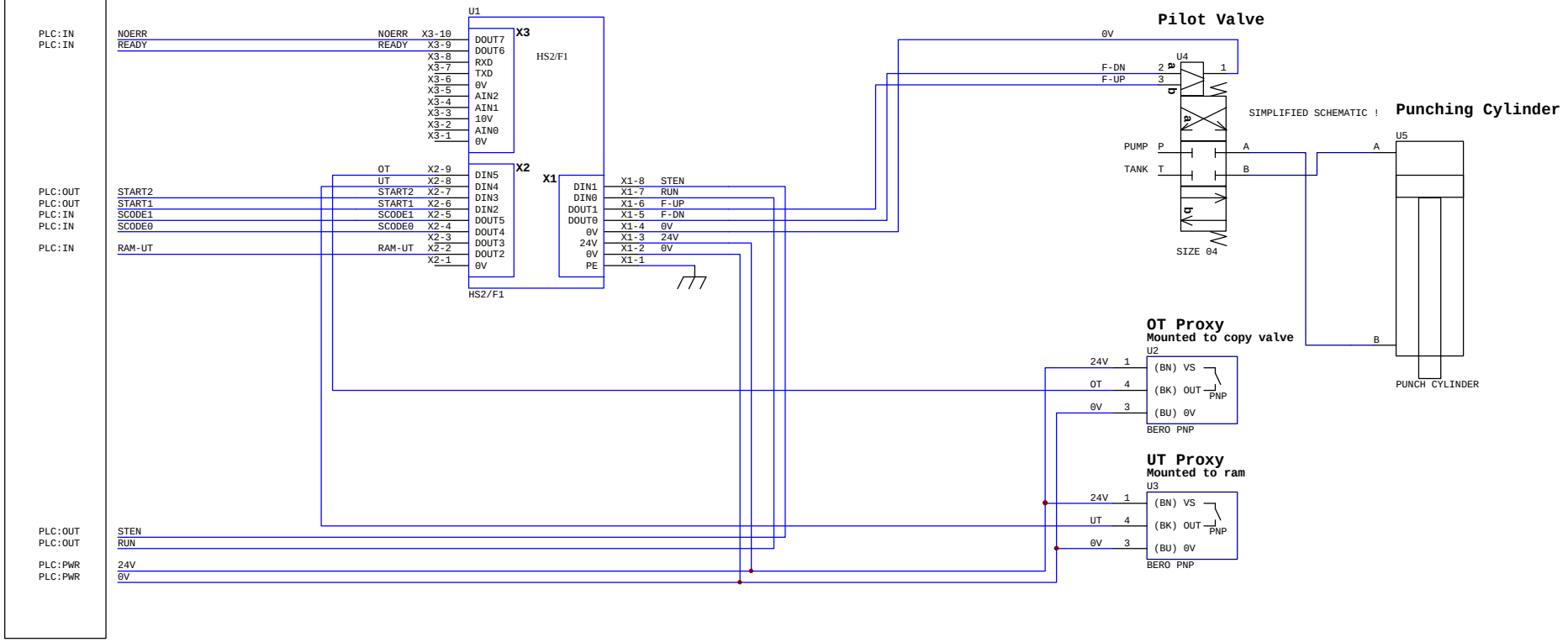
Electrical schematic: HSE/HKE electrical UT

**This schematic is focused on electrical connections.
For mechanical / hydraulical details, see mechanical drawing and/or hydraulical schematic.**

Signal Source/Dest.

PLC:IN Signal from H+L to customer PLC/CNC
PLC:OUT Signal from customer PLC/CNC to H+L, HD_CHARGE: 1A, all others: 0,1 A

PLC:PWR 24V power supply



St.	ERSTELLT	GEPRÜFT	Bemerkung
1	14.11.02/Hai		Design
2	19.11.02/Bra		HSE dedicated version

File: T:\PROJ\H_L\0000\0007\20\DOK\MAN\LPE2HSE.SCH

Hartmann + Lämmle GmbH & Co. KG
Ölhydraulik
Schuckertstraße 15
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Projekt : HKE/HSE/ECO
Untergruppe : HS2/F1
Bezeichnung : LOGIKPLAN
Zeichn.-Nr. : 79-0000-0007-20-LPE2
Blatt : 1 **VON** 3

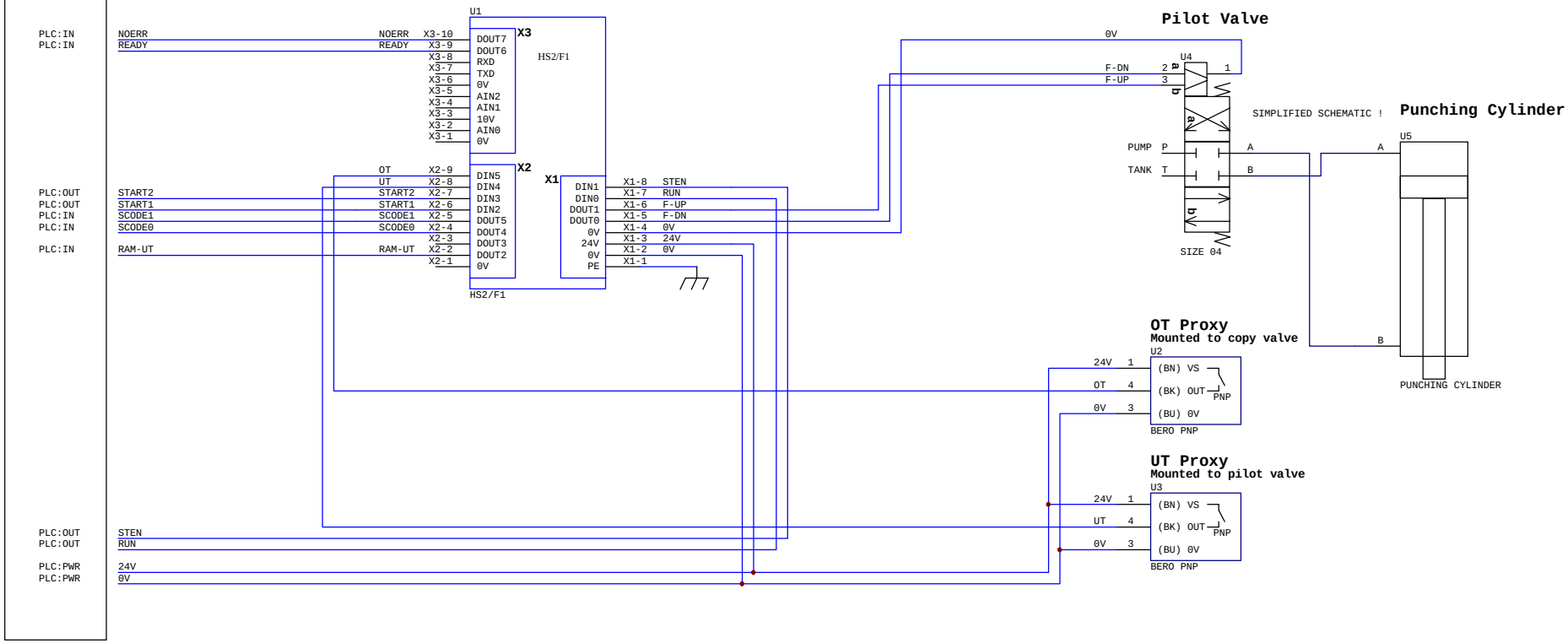
Electrical schematic: HSE/HKE mechanical UT

**This schematic is focused on electrical connections.
For mechanical / hydraulical details, see mechanical drawing and/or hydraulical schematic.**

Signal Source/Dest.

PLC:IN Signal from H+L to customer PLC/CNC
PLC:OUT Signal from customer PLC/CNC to H+L, HD_CHARGE: 1A, all others: 0,1 A

PLC:PWR 24V power supply



St.	ERSTELLT	GEPRÜFT	Bemerkung
1	14.11.02/Hai		Design
2	19.11.02/Bra		HKE dedicated version

File: T:\PROJ\H_L\0000\0007\20\DOK\MAN\LPE2HKE.SCH

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D-71277 Rutesheim

Projekt	: HKE/HSE/ECO
Untergruppe	: HS2/F1
Bezeichnung	: LOGIKPLAN
Zeichn.-Nr.	: 79-0000-0007-20-LPE2
Blatt	: 2 VON 3

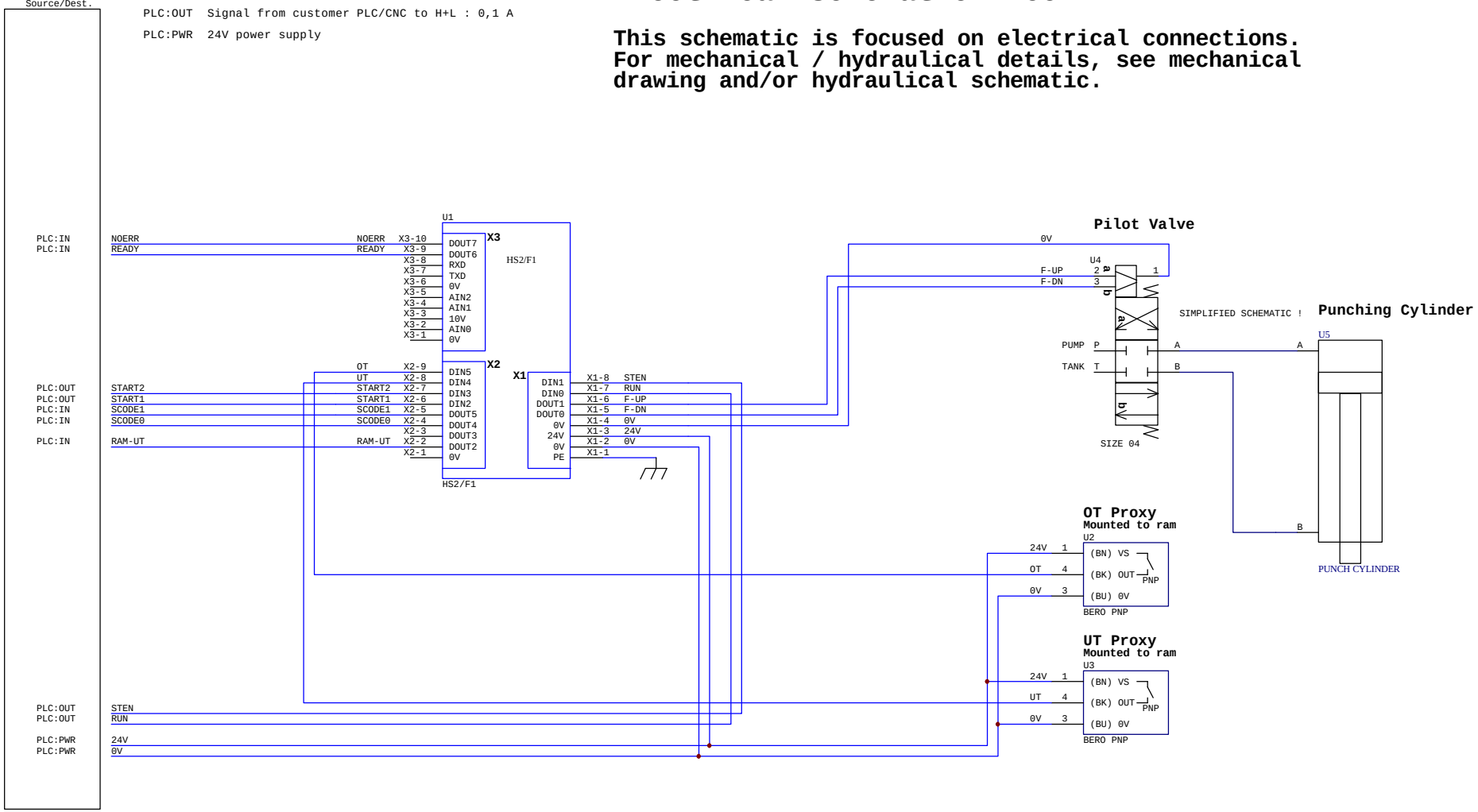
Electrical schematic: ECO

**This schematic is focused on electrical connections.
For mechanical / hydraulical details, see mechanical drawing and/or hydraulical schematic.**

PLC:IN Signal from H+L to customer PLC/CNC

PLC:OUT Signal from customer PLC/CNC to H+L : 0,1 A

PLC:PWR 24V power supply



St.	ERSTELLT	GEPRÜFT	Bemerkung
1	14.11.02/Hai		Design
2	19.11.02/Bra		ECO dedicated version

SCHUTZVERMERK NACH DIN 34 BEACHTEN
BAUTEILWERTE NUR ZUR ORIENTIERUNG:
ES GILT DIE STÜCKLISTE/BESTÜCKUNGSREFERENZ
File: T:\PROJ\H_L\0000\0007\20\DOK\MAN\LPE2ECO.SCH

Hartmann + Lämmle GmbH & Co. KG
Ölhydraulik
Schuckertstraße 15
D-71277 Rutesheim

Projekt	: HKE/HSE/ECO
Untergruppe	: HS2/F1
Bezeichnung	: LOGIKPLAN
Zeichn.-Nr.	: 79-0000-0007-20-LPE2
Blatt	: 3 VON 3