PRODUCT DESCRIPTION

The control unit CU-DR01 AC/DC is a device for manage the AC/DC thyristor converter in B6C topology and in 12 pulse master – slave configuration.

The system consists of the following devices:
a control unit (CU-DR01 AC/DC),
an operator panel (PU600),
an interfacing board (CSP131) for measure the incoming line current, DC link voltage and a voltage and current external reference,
an interfacing board (CSP130) for convert the 6 optical signal coming from the regulator to 6 thyristor pulses,
a synchronize analog board (CSP122) for measure the three phase incoming line voltage,
a thyristor power module.

The control unit, CU-DR01 ACD/DC, interfaces with the power section by means of optical fibers and through a DB25 cable.
The analog signals come from the CSP131 board through a DB25 cable, the optical fibers are connected to the CSP130 board for the thyristor interfacing. A digital output enable signal is used for interfacing the CSP130 board with the CU-DR01 AC/DC control unit.
The control unit CU-DR1 also provides:

- 13 digital input.
- 6 digital output.
- 4 analog output 0/10V.
- Profibus interface.
- Operator panel.

In the 12 pulse AC/DC thyristor converter, 2 control unit CU-DR01 AC/DC are needed, the first one will command the first thyristor converter and synchronize it with the first three phase incoming line voltage, the second control unit will command the second thyristor converter and synchronize it with the second three phase incoming line voltage. In this 12 pulse function mode, the first control unit will transmit a command word and a current reference to the second control unit.
In this way the second control unit (slave unit) will receive this data from the master control by a i2C communication link data connected to the X99 connector by a Cat.6 lan cable.
The second control unit (slave unit) will transmit the actual status and the actual current in the slave unit to the master control for the correct data exchange from the two units.

To supply the control board is needed an external 24Vdc.
The control rack is supplied via the control terminal X9 with an external supply voltage of 24Vdc, and is interfaced with the interfacing card CSP131B by the connector X8.
The three-phase voltage for synchronization with the power supply must be connected to the terminal X4, this 3 voltages (plus the neutral connection) came from the CSP122 board for the conversion 690Vac / 38 Vac.

The digital inputs of the control rack can be connected in order to receive commands from the PLC (when is not used the Profibus communication) or to receive the status of some external protections to configure alert actions or failure events with which disable the drive running (for example the thermal protection, the fuse status from the thyristor converter).

The operating panel called PU600, mounted on the front panel that contains the control rack (at a distance of less than 2 meters) is connected to the terminal X5, through it is possible visualize and modify the current data of the drive, as well as communicate through a USB port on a PC.

The control system CU-DR01 AC/DC is placed within a rack and must be fixed on a metal plate not far from the CSP131B board (less than 20 meters) and not far from the CSP130B board (distance less than 20 meters), then the CSP130B board has to be mounted near the power converter (distance less than 2 meters).

TECHNICAL SPECIFICATIONS

In the following table are resumed some technical data of the control rack CU-DR01 AC/DC and the operator panel PU600

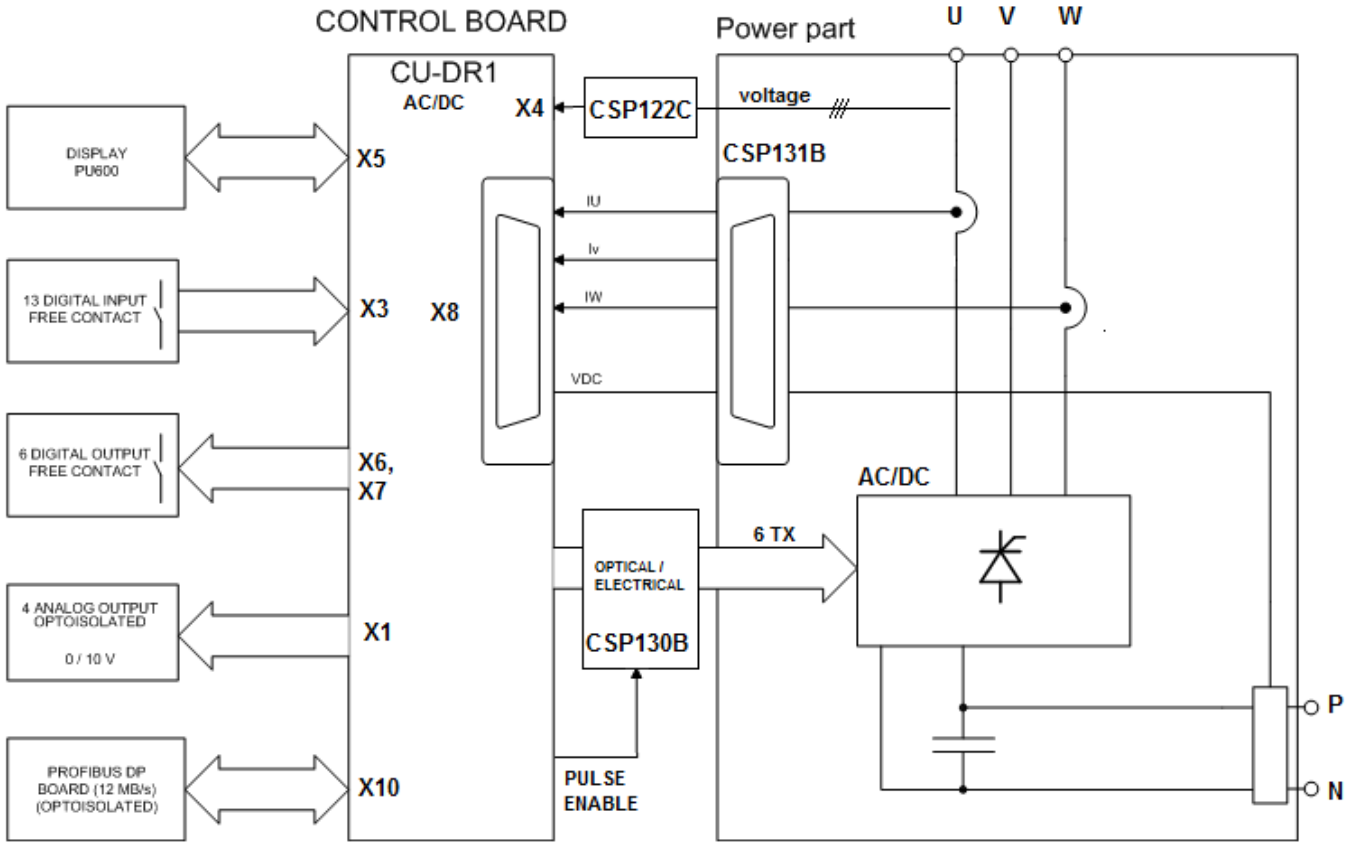
Power supply	24Vdc (in the range of 18Vdc ÷ 36Vdc), max 1A
Digital Inputs	12 + pulse enable
Digital Inputs voltage	in the range of 10Vdc ÷ 30Vdc
Digital Inputs Min current	4 mA
Digital Inputs max current	15 mA
Digital Inputs isolation voltage (from control)	3 kV
Digital Outputs (free of voltage)	6
Nominal voltage of the output free contact	250 Vac
Nominal current of the output free contact	10 A
Number of synchronization inputs	3
Nominal Voltage	38 Vac (correspond to 690Vac line/line voltage at CSP122C input)
Max Voltage of synchronization inputs	50 Vac (correspond to 900Vac line/line voltage at CSP122C input)
Analog Output	4
Output Voltage	0 ÷ 10Vdc
Analog Output isolation voltage	2 kV
Communication Protocol	Profibus
Number of input word	16
Number of output word	16
Number of bit for each word	16
Maximum communication speed	12 MBaud
Converter topology managed	B6C, 12 pulse master-slave converter.
Communication protocol in 12 pulse master-slave converter	I2C
Cable type for communication between master and slave	FTP Cat.6 patch cable.
Output optical fiber (transmission)	6
Maximum length of optical fiber	20 meters
Type of optical fiber	Plastic Optical Fiber (typical attenuation 0,22 dB/m with 660nm source led), external diameter = 1mm
Interfacing with power section	through optical fiber (6 in transmission) by the CSP130B board And with 25-pin connector by the CSP131B board
Communication between operator panel and control rack	FTP Cat.6 patch cable.
Control rack dimension	Width 70 mm - Height 300 mm - Depth 280 mm
Control rack weight	4 Kg
Operator panel dimension	Width 167 mm - Height 117 mm - Depth 47 mm
Panel cutout in the switchboard door	Width 150 mm – Height 91 mm
Operator panel weight	0.5 Kg
Ambient temperature:	
Storage	From -20℃ to 80℃
Operation	From -10℃ to 65℃

CONTROL SYSTEM ARCHITECTURE

In the following figure is illustrated the control system architecture. The control unit, called CU-DR1, interfaces with the power section by means CSP130B board for the optical fibers and with the CSP131B board for the analog signal through a DB25 cable. The control unit CU-DR1 also provides:

- 13 digital input.
- 6 digital output.
- 4 analog output 0/10V.
- Profibus interface.
- Operator panel.

The input / output units are summarized in the figure below:



CONTROL SYSTEM LAYOUT

The control system CU-DR01 AC/DC is placed within a rack and must be fixed on a metal plate at not more than 20 meters from the power unit.
The figure below shows the control rack layout with the position of the connectors.

At the top of the control rack control the following connectors are present:

- X4: synchronization connector
- X1: analog output connector,
- X3: digital input connector,
- X2: digital power supply,
- X99: data connection from master and slave control rack.

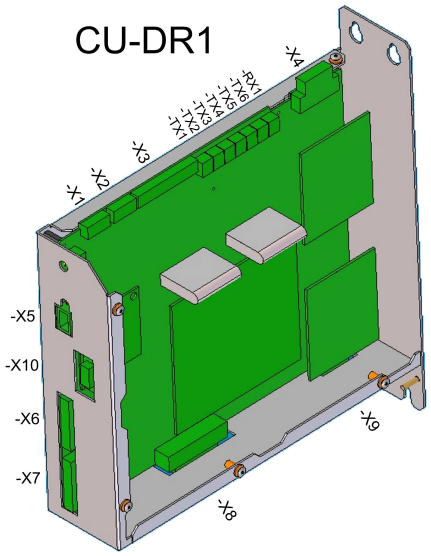
There are also the 6 optical fiber transmission (TX1-TX6, or U_H,V_H,W_H, U_L, V_L, W_L) for the CSP130 board, this board interface the optical fibers to the power section

In front of the control rack the following connectors are present:

- X5: PU600 operator panel connector
- X10: Profibus connector
- X6: Relay digital output connector (2)
- X7: Relay digital output connector (4)

At the bottom of the control rack the following connectors are present:

- X8: 25-pin connector for interfacing to the CSP131 board, this board interface the 3 ac current transformers and the DC link voltage to the control rack,
- X9: Power supply connector for the control rack.

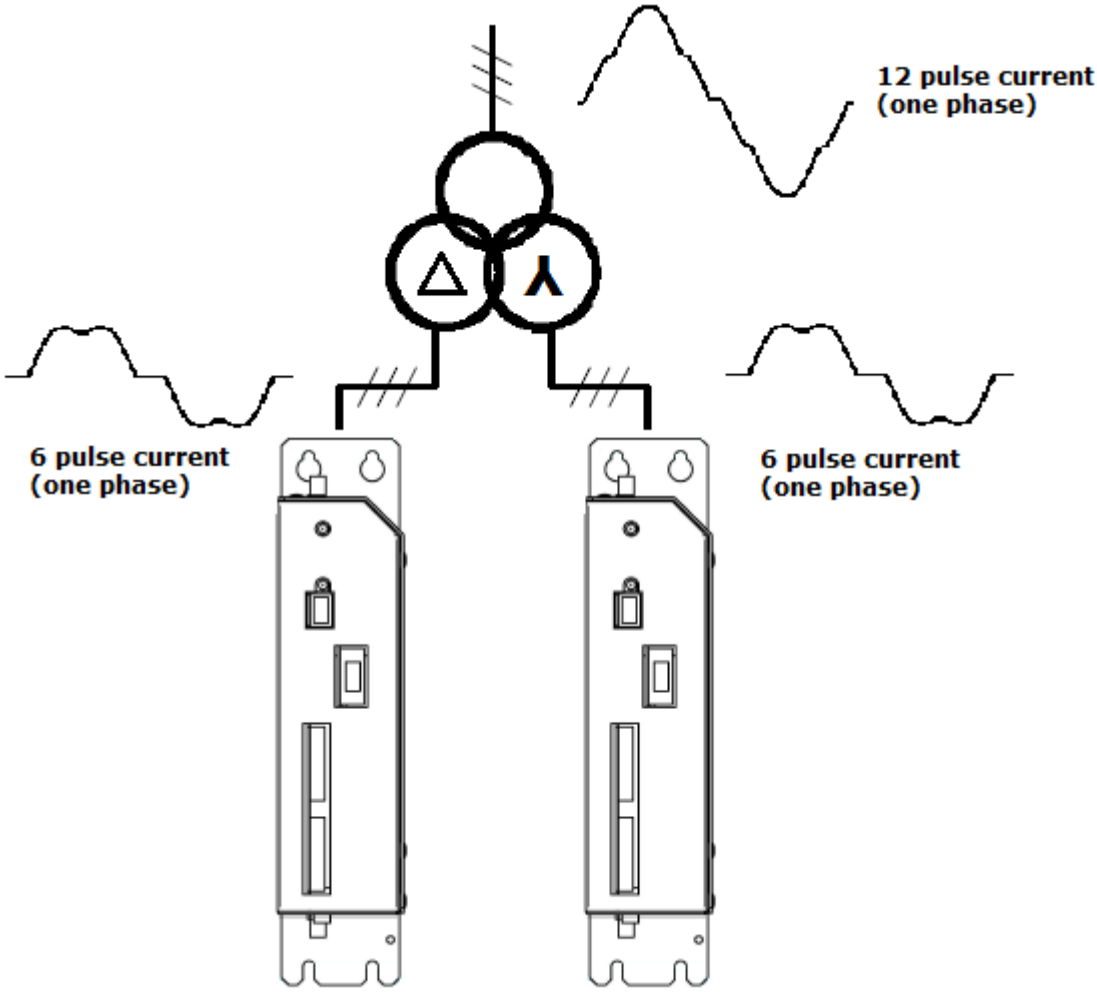


12 PULSE MASTER-SLAVE CONFIGURATION

The characteristic features of 12-pulse are:

- a DC drive consisting of two 6-pulse thyristor converters,
- a dedicated two secondary winding transformer providing the AC power for both converter modules from separate secondary windings with a phase shift difference of the windings equal to 30°.

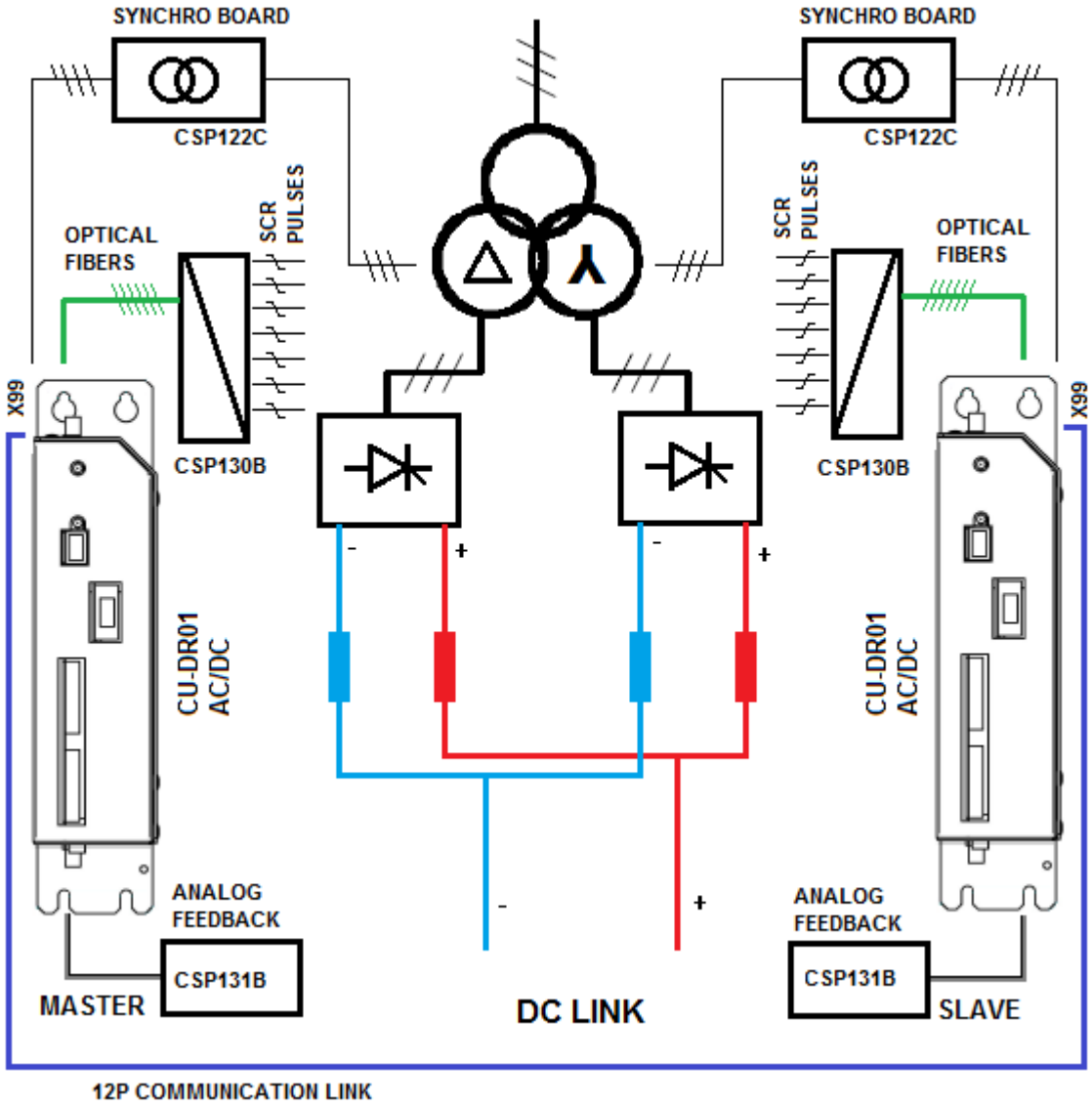
An example is a Delta / Delta / Star transformer:



The most significant advantages of 12-pulse technology are:

- reduced level of harmonics on the primary side of the transformer,
- expansion of the power range by doubling the dc output current (parallel configuration)

Below is possible to see the overall control system for 12 pulse AC/DC converter control:



The two AC/DC converter bridges are composed by 6 thyristors each one connected in the B6C topology.

For each converter:

- the thyristors pulses are provided by an optical / pulse converter board (CSP130B) with external enabling signal,
- the six optical signal are provided by the CU-DR01 AC/DC control rack.
- the analog feedback signal like ac current and dc link voltage are provided by two transformer current and an amplifier board CSP131B,
- the synchronization voltage are provided by a transformer board CSP122C

One control rack is called Master control, the other is the Slave control.

In the master-slave configuration is necessary to set the parameter:
P123_control_mode=1 (12P master) in the master control rack,
P123_control_mode=2 (12P slave) in the slave control rack.

The communication between the two control rack CU-DR01 are provided by a 12 pulse communication link composed by a cat6 LAN cable connected in the X99 connector of each control rack. The X99 connector is present in the upper part of the CU-DR01 control rack, near the optical fiber, this connector is mounted only when the control rack is ordered with the option master or slave.

The source command for the 12 pulse control system can be chosen from:
Service (the commands are given by the panel unit PU600),
Dig input (the commands are given by digital input X3:1, X3:2, X3:3 of the master control rack),
Profibus (the commands are given by the profibus data exchange of the master control rack).

The command for preset and start the 12 Pulse control system has to be given only in the master control rack, then the command to the slave and also the current reference are transferred to the slave control rack by the 12 pulse communication link.

Below is possible to see the data exchange when the source command is profibus.