

ScopeDome
sky observatory



Manual

ScopeDome USB Card ver. 2.1

The specificity of astronomical observations are periods of breaks resulting from the lack of adequate weather. It happens that observatories are not used for several months. At this time, moisture can build up on electronic components, which, if you try to run the observatory again, may cause a short circuit and damage to the dome control system. To avoid this, we recommend keeping the observatory under voltage all the time so that the electronic heating system can protect sensitive elements from potential failure.

Failure to comply with the above recommendation will result in not taking into account any warranty service requests.



ScopeDome USB Card ver. 2.0

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fig. 3a Home Sensor

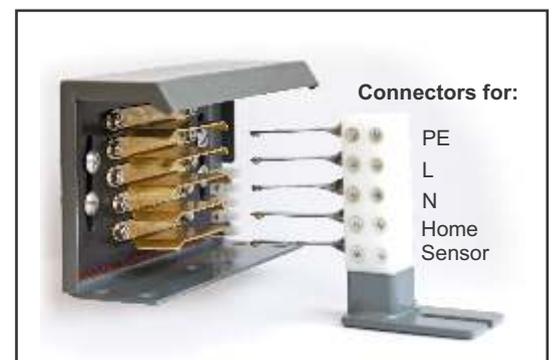


fig. 6a Power contacts for 3M Dome (old version)

1. Technical information

Along with the card, depending on the order, we provide the following components:

Stationary part:

- Dimensions: 200x120x75 mm (LxWxH)
- Weight: 1 kg
- Power consumption 12VDC: 600 mA (~ 10W)
- Power consumption 230VAC: 50 mA (~ 10W)
- Current efficiency of AC outputs:
- 12V out: 200 mA
- 5V out: 150 mA

Power consumption of the inverter set with the engine with the power of 90W:

- standby mode (engine does not rotate) : 25 mA
- engine without load : 300 mA
- engine with load: 860 mA
- overload engine: 1A

Maximum relay load :

- Scope, CCD, LIGHT, FAN: 4A
- Rel1, Rel2, Rel3, Rel4: 2A
- CW, CCW, OPEN, CLOSE relays and inverter control outputs: 2A

Total relays load must not exceed 8A

Moving part

- Dimensions: 200x120x75 mm (LxWxH)
- Weight: 1 kg
- Power consumption 12VDC: 300 mA (~ 4W)
- Power consumption 230VAC: 20 mA (~ 4W)
- transmitter range: ~ 5 m

Home Sensor

- Dimensions: 47x47x27 mm (LxWxH)
- Sensor fork spacing: 15 mm
- Sensor fork depth: 12 mm

Encoder

- Dimensions: 47x47x27 mm (LxWxH)
- Sensor fork spacing: 15 mm
- Sensor fork depth: 12 mm
- Radio remote
- Dimensions: 85x36x15 mm (LxWxH)
- Battery life: ~ 3 months
- Transmitter range: ~ 3m

Hygrometer

(fig. showing mounting holes)

- Dimensions: 64x58x35 mm (LxWxH)
- Maximum wires lenght: 2m

Thermometer TempIn and TempOut

- Dimensions: 35x12x10 mm (LxWxH)
- Maximum wires lenght: 5m

Power contacts of the card moving part

(for ScopeDome 4M & 5.5M)

- Dimensions (part with rolls): 120x48x40 mm (LxWxH)
- Dimensions (part with power contacts): 120x48x20 mm (LxWxH)

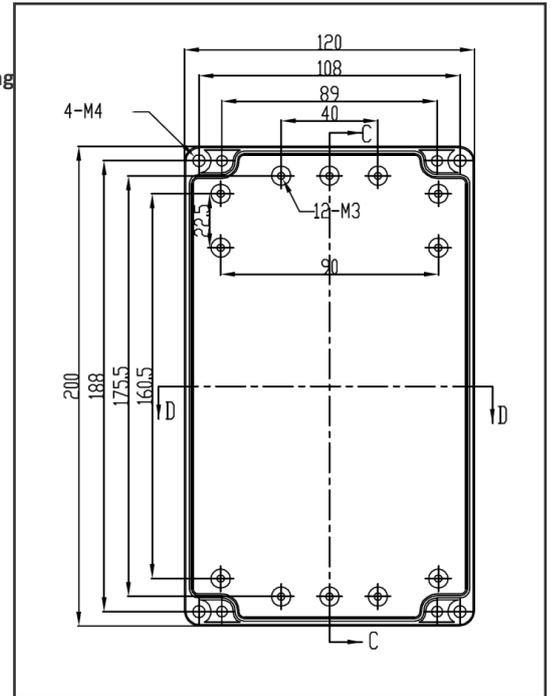


fig. 1 Mounting holes for stationary and rotary part

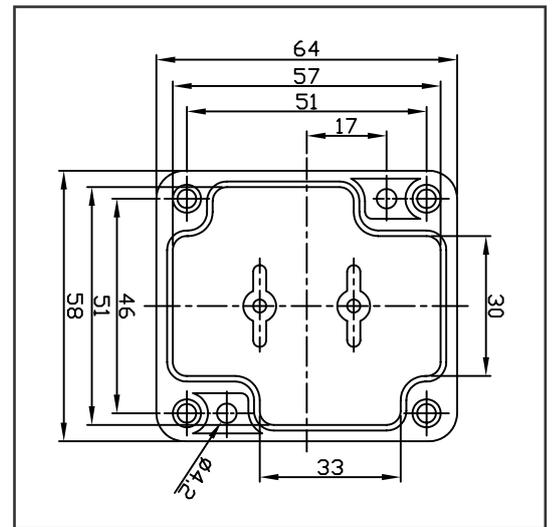


fig. 2 Mounting holes for Higrometer and HomeSensor

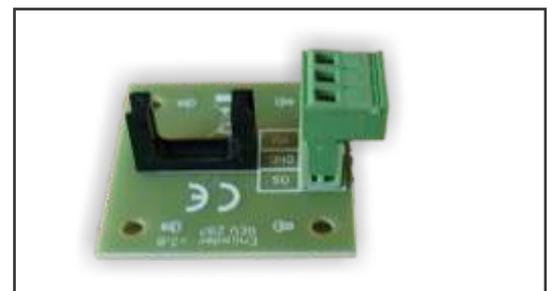


fig. 3 Enkoder and HomeSensor board

2. Basic information about the card

Wireless ScopeDome USB Card ver. 2.0 is designed to control the astronomical observatories.

It consists of four basic elements:

- stationary main part - mounted at the telescope, which controls the rotary engine of the dome,
- moving part - mounted on the movable part of the dome, which controls single or double shutter
- wireless remote for convenient control the movement of the dome during visual observations,
- control software for Windows.

Versatile design of our card allows to control different types of domes. With eight built-in relays it allows to control the powering of the observatory's equipment such as telescope, camera, lighting, ventilation. The card is equipped with the necessary inputs that indicate the current status of the dome and the input for encoders which measure the azimuth and position of the shutter. Part of the card that controls the shutter communicates with the main part of the card through a radio transmission or by wire, using the RS 485 interface. Communication of our card with the telescope is realized by ASCOM platform 6.0 or TheSky6 sky atlas. Card is designed to work with selected sorts of weather stations and cloud sensors.

3. The range of possible applications

ScopeDome USB Card ver. 2.0 allows you to control the domes of different manufacturers equipped with single or double shutter and all kinds of observatories Roll-Off Roof type. The system of outputs that control the operation of engines which drive the dome and the shutter is versatile and allows you to use any engine - from typical 12V DC motors (for small domes), through the stepper motors, up to three-phase AC motors. If you use a 12V motors, you have to use the appropriate Relay Box. Communication of the card and the computer is provided via USB port.

The software enables to use the card to control the domes of any diameter. The card has a built-in universal power supply 110 or 230V AC, it can also be powered with a typical power supply of 12V DC.

4. Plug And Play and an additional watertight Fibox boxes

For domes produced by us, upon request, we provide the card with an integrated wiring Plug And Play, adapted to a typical observatory control scheme. It allows you to instantly connect and run the card without knowledge of electrical schematics and experience in the electrical installations. Additionally, there is the possibility of installing the card in a high quality, aesthetic and watertight enclosures FIBOX.



fig. 4 Thermomter TempIn i TempOut



fig. 5 Remote Controll

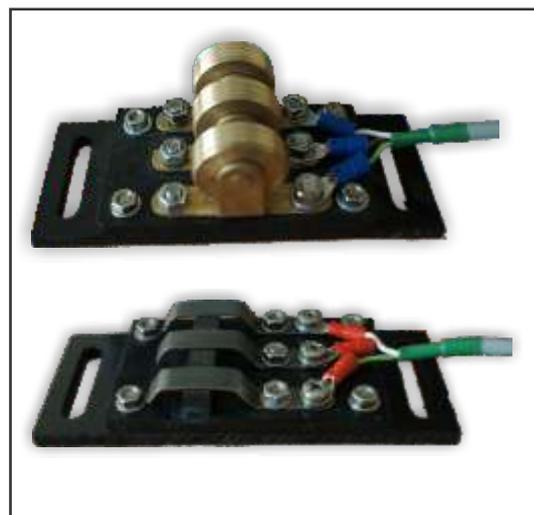


fig. 6 Power contacts for 4M i 55M dome



fig. 7 Watertight boxes

5. Basic card hardware functions

1. Control of rotary engine and measuring the azimuth of the dome.
2. Control of the single or double shutter engines and providing an information about their current mode. Each of the shutter parts can be equipped with an encoder that measures its position.
3. Power control up to eight devices of the observatory equipment.
4. Emergency shutdown of the shutter in the case of power failure in the grid.
5. Emergency shutdown of the shutter in the case of battery power failure.
6. Emergency shutdown of the shutter in the case of bad weather conditions.
7. Emergency shutdown of the shutter in the case of losing the connection with the control computer.
8. FindHome – searching for HomeSensor position.
9. Remembering the position of the dome after power off.
10. Supporting the rain and cloud sensors.
11. Safe Observatory input to hardware blocking the action of engines.
12. ScopeAtHome input.
13. Displaying basic informations about the status of the observatory's sensors.
14. Measurement of internal and external temperature, measurement of humidity and atmospheric pressure.
15. Measurement of current-voltage batteries, which supply the dome.
16. The internal card remote firmware revision procedures, without being physically present at the observatory.

6. Description of the card's inputs and outputs

ATTENTION

- **OUTPUTS WHERE THERE IS HIGH VOLTAGE ARE MARKED IN RED - BEFORE THEIR CONNECTING THE CARD SHOULD BE DISCONNECTED FROM POWER.**
- **WHEN CONNECTING THE CARD TO 230/110 VAC POWER GRID YOU MUST CHECK THE WIRES POLARITY L (PHASE), N (GROUND), AND PROPERLY CONNECT THE PROTECTIVE WIRE PE. INCORRECT CONNECTION CAN DAMAGE THE COMPUTER CONTROL AND CAUSE A MALFUNCTION OF THE CARD.**

ALL INPUTS AND OUTPUTS OF THE CARD HAVE SCREW TERMINALS, MAXIMUM SUITABLE WIRE CROSS SECTION IS 2.5 MM².

Stationary main part

Power

- Line 230VAC – power loss sensor input
- UPS 230 VAC – 110 or 230 VAC main power input of the card
- OUT 230 VAC – auxiliary output to 230 VAC power supply for other devices, intended to connect the card's moving part power adapter
- DC IN 12V – 12V power input of the card
- DC OUT 12V/5V – 12V/5V (0.5A) stabilized output voltage from an internal power adapter on the card that can be used to power the equipment of the observatory
- RS485 - output to wired control the moving part of the card

Power control of the equipment inside the observatory

- FAN - 230V power supply output for control of cooling or heating the observatory
- SCOPE - 230VAC power supply output to control the telescope's power
- CCD - 230VAC power supply output to control CCD camera's power
- Relay1 - relay contacts output No / NC for any use
- Relay2 - relay contacts output No / NC for any use
- Relay3 - relay contacts output No / NC for any use
- Relay4 - relay contacts output No / NC for any use

Control of the rotary engine

- Dome Inverter
- COM, CW, CCW - outputs to control the inverter motor or RelayBox module
- L, PE, N - 230VAC output to power the inverter

Observatory current state sensors inputs

- Cloud Sensor – logic input of the cloud sensor cooperating directly with AG CloudWacher and Boltwood Cloud Sensor
- DomeAtHome – logic input of the dome's home sensor
- Dome Enkoder – dome encoder input
- Obs. Safe – logic input to block the engines in the case when the dome's movement could damage the equipment inside the dome, especially the telescope
- Scope AtHome – logic input detecting that the telescope is parked
- Free Input – logic input for any use
- Analog Input – analog input for measuring the voltage of the battery that powers the main part of the card

Working with hardware extensions

- RS485 – output for optional extension in RS485 standard

Communication with PC

- USB – USB port for communication between the card and PC

Moving part (Rotate)

Power

- UPS 230 VAC – main input of 110 or 230 VAC
- DC IN 12V – 12V power input of the card
- RS485 – output for wire control of the moving part of the card

Power control of the equipment inside the observatory

- LIGHT – 230V power supply output for control the upper lightning in the moving part of the dome

Control of the shutter engine no. 1

- Shutter Inverter - 1
COM, Open, Close – outputs to control the inverter motor or RelayBox module
L, PE, N – outputs of 230VAC to power the inverter
- Close1 Sensor – logic input of the shutter no. 1 closing sensor
- Close1 LS – shutter no. 1 limit switch input
- Open1 Sensor – logic input of the shutter no. 1 opening sensor
- Open1 LS – shutter no. 1 limit switch input

Control of the shutter engine no. 2

- Shutter Inverter - 2
COM, Open, Close – outputs to control the inverter motor or RelayBox module
L, PE, N – outputs of 230VAC to power the inverter
- Close2 Sensor – logic input of the shutter no. 2 closing sensor
- Close2 LS – shutter no. 2 limit switch input
- Open2 Sensor – logic input of the shutter no. 2 opening sensor
- Open2 LS – shutter no. 2 limit switch input

Observatory current state sensors inputs

- Hygrometer – input for humidity and temperature sensor
- Rain Sensor – logic input of the cloud sensor cooperating directly with AG CloudWacher and Boltwood Cloud Sensor
- Shutter 1 Encoder – encoder input of the shutter no. 1
- Shutter 2 Encoder – encoder input of the shutter no. 2
- Analog Input – analog input for measuring the voltage of the battery that powers the main part of the card
- Temp. In – internal thermometer input
- Temp. Out – external thermometer input

7. Description of the card's control panel and LED indicators

Control buttons

- On/OFF – power on/off button that switches the card into StanBy mode
- Telescope – power on/off the telescope
- CCD – power on/off CCD camera
- Light – power on/off the upper lightning inside the dome
- Fan – power on/off the fan
- Shift – function button, when you push it:
 - Telescope, CCD, LIGHT, Fan buttons control and indicate the current state of Rel1, Rel2, Rel3, Rel4 relays
 - OPEN, CLOSE buttons control the movement of the second shutter (in the case when the card is configured for double shutter system – default setting is for single shutter system)
 - information of the LCD screen changes
 - pushing this button lasting a few seconds in the StandBy mode (it is indicated by green LED diode placed close to this button) - turn the card into radio transmission programming mode
- TelescopeSync – when the card cooperates with PC it allows to turn on the telescope - dome synchronization mode manually
- WindSync – when the card cooperates with PC it allows to turn on the dome - wind direction synchronization mode manually
- Weather Protect – when the card cooperates with PC it allows to turn on WeatherProtect mode manually which closes the dome in the case of bad weather conditions (raining, snowing, strong wind, cloudiness)
- Display - it is used to switch the informations displayed on the LCD screen
- CW, CCW, OPEN, CLOSE, STOP – the dome's main control buttons used to rotate it, stop it and open/close the shutter

LEDs

every control button has its own LED that indicates its current state

- NoPower – indicates the power failure on 230VAC power input sensor
- Rain – indicates Rain Sensor input
- Cloud – indicates Cloud Sensor input
- Shutter 1
 - Open – indicates the shutter Open 1 Sensor
 - Close – indicates the shutter Close 1 Sensor
 - Encoder – indicates the current state of the shutter no. 1 encoder (blinking during the shutter movement means that the encoder works properly)
- Shutter 2
 - Open – indicates the shutter Open 2 Sensor
 - Close – indicates the shutter Close 2 Sensor
 - Encoder – indicates the current state of the shutter no. 2 encoder (blinking during the shutter movement means that the encoder works properly)
- Dome AtHome – indicates the current state of the dome's Home sensor
- Scope AtHome – indicates the current state of the telescope AtHome sensor
- Free Input – indicates the current state of FreeInput sensor
- Shutter Link – indicates the correct radio connection with the moving part of the card
- Observatory Unsafe – indicates the current state of Observatory Safe input
- Low Battery – indicates that the voltage of battery that powers the card is too low

LEDs of LCD screen (Shift button is turned off)

- Dome Azimuth – displays the dome's current azimuth
- Battery – displays the voltage of the battery connected to analog input in the main part of the card
- Temp. – displays the temperature inside the dome
- Hum. – displays the humidity

LEDs of LCD screen (Shift button is turned on)

- Dome Azimuth – displays the temperature from humidity sensor
- Battery – displays the voltage of the battery connected to analog input in the moving part of the card
- Temp. – displays the temperature outside the dome
- Hum. – displays the atmospheric pressure (Hp)

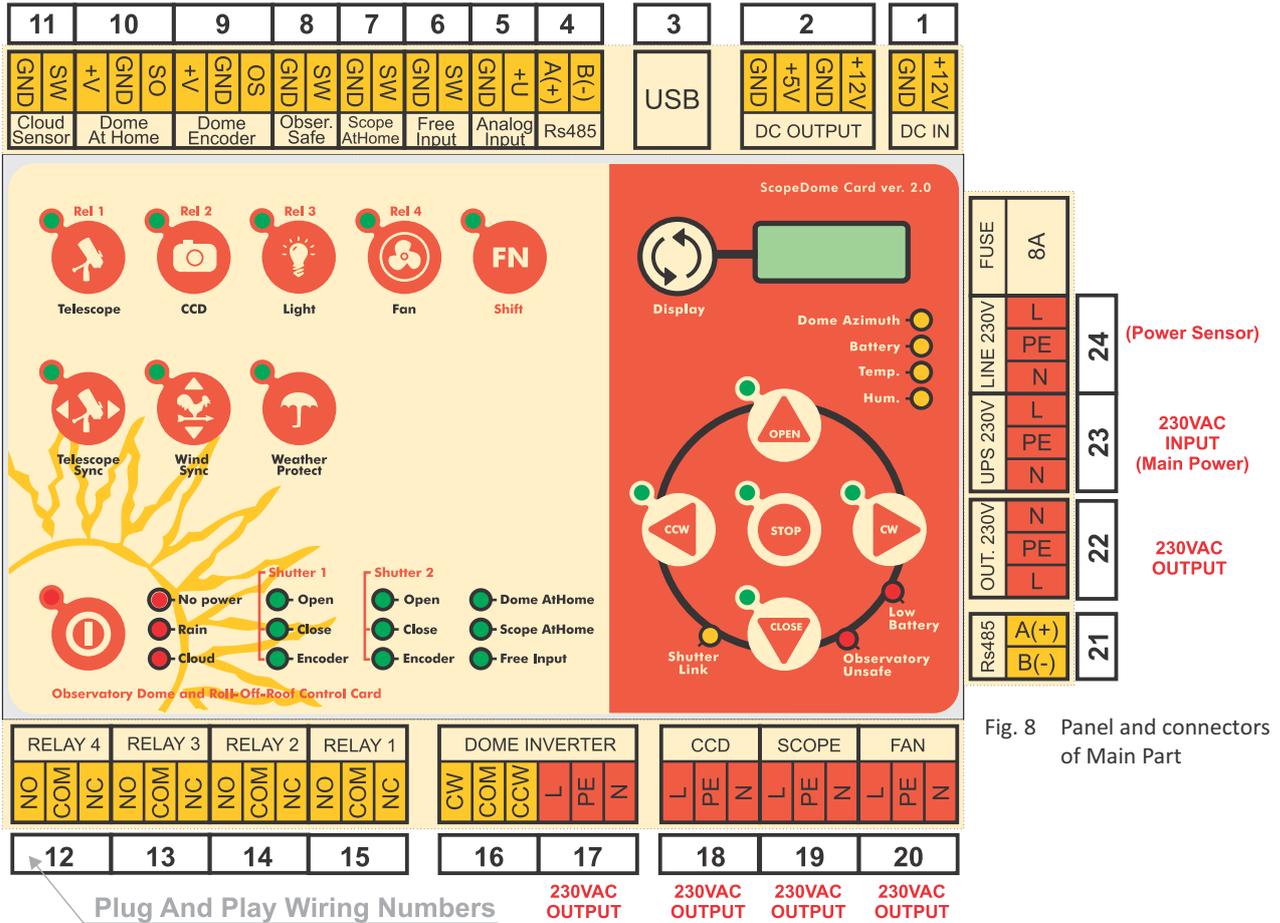


Fig. 8 Panel and connectors of Main Part

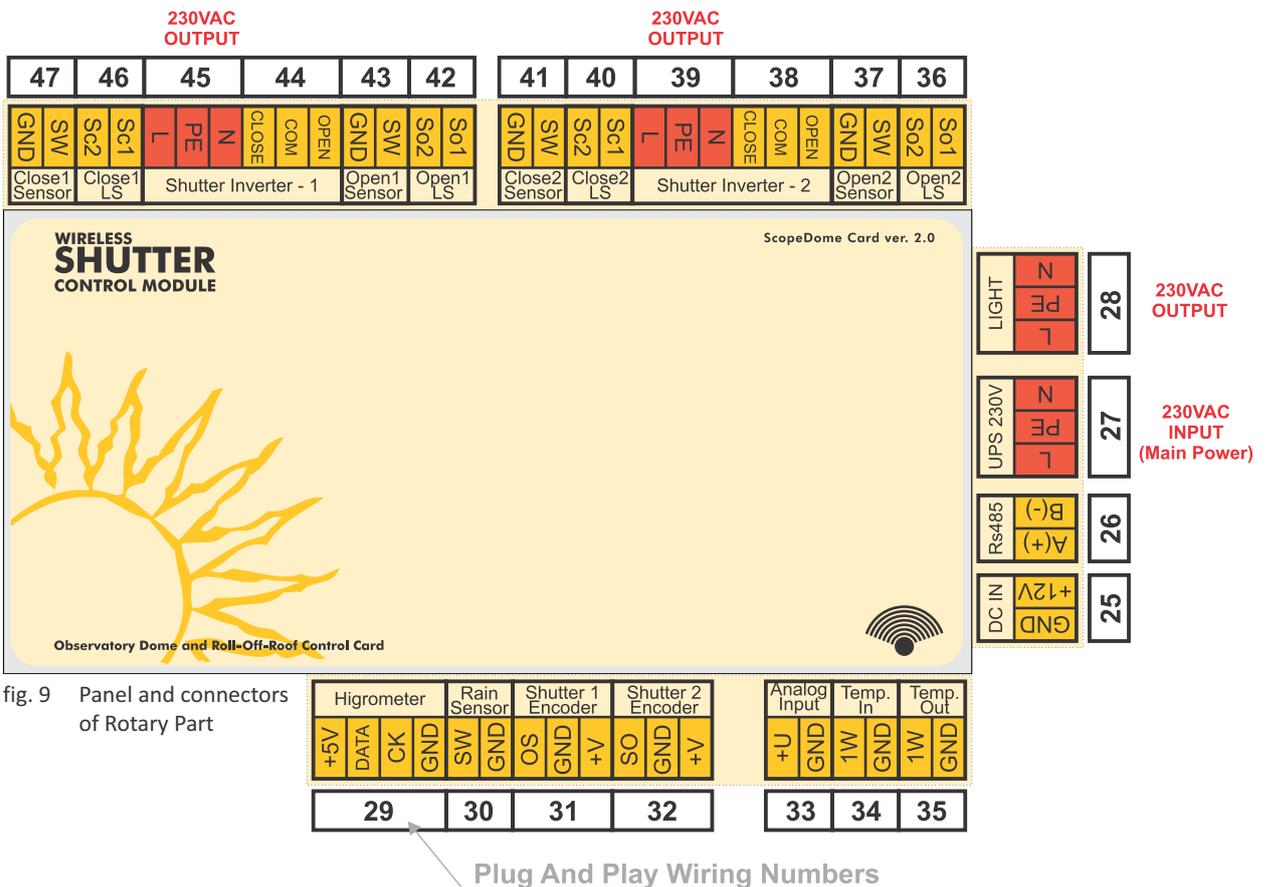


fig. 9 Panel and connectors of Rotary Part

8. ScopeDome USB Driver software

Together with the card we provide ScopeDome USB Driver software. The latest version of driver can be downloaded from our website: <http://www.scopedome.com>. You can use it to set all the card's configuration parameters. Through the ASCOM platform or TheSky6 program you can synchronize the telescope-dome position.

Using our driver you can also control the power of the equipment inside the observatory. Driver supports the most popular weather stations and cloud sensors.

Full documentation and description of all functions of the driver is in help file included with the software. Configuration parameters are also described in tips those appear when you select them with the mouse. After pressing the "Restore Default" and save the settings in the "Config" window the card should control the dome properly.

The card is equipped with additional two programs. The first of these "DCMLib_Test.exe" is a typical "low level" software to service the card. It allows you to check and set all the configuration parameters of the card. The second program is "ScopeDome_Demo.exe". It is used for demonstration and testing of the dome's drive mechanisms.

9. The first test run of ScopeDome USB 2.0 card

To test the card for the first time you have to connect the power supply to its main and moving parts and connect the card to your computer using a shielded USB cable. After connecting the card to USB port, please look at the Device Manager and the list of COM ports. You should see a virtual USB Serial Port (eg COM 40), which is associated with the ScopeDome card, based on the USB Serial Converter supplied by FTDI Company.

If the card did not appear on the list of COM and LPT ports in the Device Manager, disconnect the USB cable and then run the program CDM20814_Setup.exe. This installs the necessary drivers and sets the communication between the card and PC.

After connecting power to the two parts of the card, note that "Shutter Link" LED is on – it indicates a stable communication between the two parts of the card. If communication between parts of the card has not been properly established, go to step: "Programming radio connections".

Then install the latest version of ScopeDome USB Driver provided by ScopeDome. After first installation, the program displays only "Config" window. After successfully installation of the software, please enter the following parameters in "Config" window:

1. Enter the dome's radius in "Dome" tab
2. Choose a proper card's type in „Card Config" window tab „Select Io Card" field
3. Push „Restore Default" button at the bottom of the window
4. finally push „Save Settings" button, which closes "Config" window and opens the main control panel of the program
5. Other configuration parameters can be entered later in accordance with the information contained in the "Help" section.



fig. 10 Main Driver window

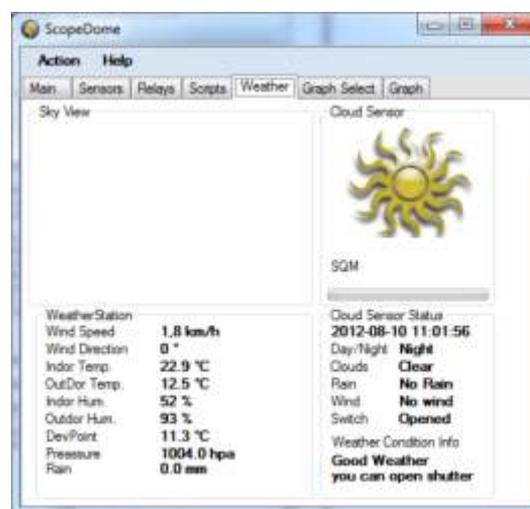


fig. 11 Weather window



Fig. 12 Card parameters configuration window

After this stage, the software should go to the main control window of the observatory without any error messages. The card should also communicate with the control PC properly. This can be easily checked by pressing CW, CCW, Open, Close buttons, or turning on the power of the telescope, CCD camera or lighting inside the observatory. On the card the appropriate LEDs indicating the status of the relays should light up (there should also be an audible sound - the characteristic "click" of the relay). ScopeDome USB Driver should properly display the status of the card's relays on a computer screen. There also shall be a possibility to control the card from the PC. Pressing the CW, CCW, Open, Close buttons, and buttons that control the power of the equipment inside the observatory in the main window of the control program - should enable and disable the corresponding relays on the card.

If the driver did not establish communication with the card, an error dialog with the message: "ScopeDome Card USB v2.0 is not connected" will display. In this case, you should first check if a virtual COM port associated with the card is visible in the list of devices connected to the computer, and then again try to run the program. If this message persists, please contact us by Skype or by phone.

Our Skype software service is available through an account with nick: "JacekPala" - preferably "chat" connection type.

ATTENTION

TO CONNECT THE USB SCOPEDOME CARD WITH A COMPUTER, DUE TO THE CONTROL OF HIGH-POWER ENGINES WHICH ARE CONNECTED TO 230 VAC (INDUCTIVE LOAD), IT IS NECESSARY TO USE VERY WELL SHIELDED USB CABLES. IT IS ALSO NECESSARY TO CHECK THE PROPER CONNECTION OF 230VAC POWER SUPPLY LINES (L, N, PE). INCORRECT WIRING MAY DAMAGE THE CONTROL COMPUTER IN THE OBSERVATORY. IT CAN ALSO BE A REASON OF AN UNSTABLE WORK OF SCOPEDOME USB CARD.

10. Connecting the dome drives and sensors to ScopeDomeUSB 2.0 card

After verifying proper operation of the card at a basic level, you are ready to connect the drives and all other sensors. A good idea is not to connect all these elements at once but rather as step by step procedure. At each stage check whether the connected components do work properly. We suggest the following sequence of connection:

1. The engine and inverter of rotary drive
2. Home Sensor
3. Dome encoder
4. Close Limit Switch
5. Open Limit Switch
6. The engine and inverter of the shutter drive
7. Other weather and power sensors (thermometers in and out, hygrometer, rain and cloud sensor or sensor, power failure sensor)
8. Power Supply (UPS)
9. Remote control

NOTE

CUSTOMERS WHO PURCHASED VERSION PLUG AND PLAY WIRING CAN JUST INSTANTLY CONNECT ALL THE CABLES IN ACCORDANCE WITH THEIR NUMBERS. THE ENTIRE OBSERVATORY AUTOMATION IS BEING PREPARED AND CHECKED BY US. BEFORE SENDING PLUG AND PLAY SYSTEM WE ALWAYS TEST IT FOR A FEW HOURS IN OUR LABORATORY.

SELF-CONNECTION OF THE CARD, ENGINES AND SENSORS REQUIRES EXPERIENCE IN READING AND UNDERSTANDING ELECTRICAL SCHEMATICS, AND SOME MANUAL SKILLS. IN OUR OPINION THIS IS A TYPICAL TASK FOR THE ELECTRICIAN PERFORMING ELECTRICAL INSTALLATIONS IN DETACHED HOUSES. IT WILL BE WELCOME IF THE PERSON INSTALLING THE CARD WILL HAVE AT LEAST MINIMAL EXPERIENCE IN INDUSTRIAL AUTOMATION SYSTEMS OR IN "SMART HOME" INSTALLATIONS.

How do I check the correct functioning of HomeSensor?

After connecting "Home Sensor" according to the scheme turn the card on and cover the sensor's fork by anything (eg a piece of paper). If Home Sensor is functioning properly, "Dome At Home" LED indicating his condition should light and fade.

How do I check the correct functioning of Dome Encoder?

The encoder test procedure is identical to "Home Sensor". The only problem is that the state of the dome's position encoder is not displayed directly on the card panel. If you have not installed ScopeDome USB driver yet, the simplest way to test is to connect the encoder plug in Home Sensor input and watching "Dome At Home" LED. If you already have a computer connected to the encoder, you can watch the action on screen. During the rotation of the dome (CW and CCW buttons) the azimuth of the dome should change. Sensor status can be read directly by selecting "Sensors" tab in the main window. Encoder state is indicated by "Az Counter".

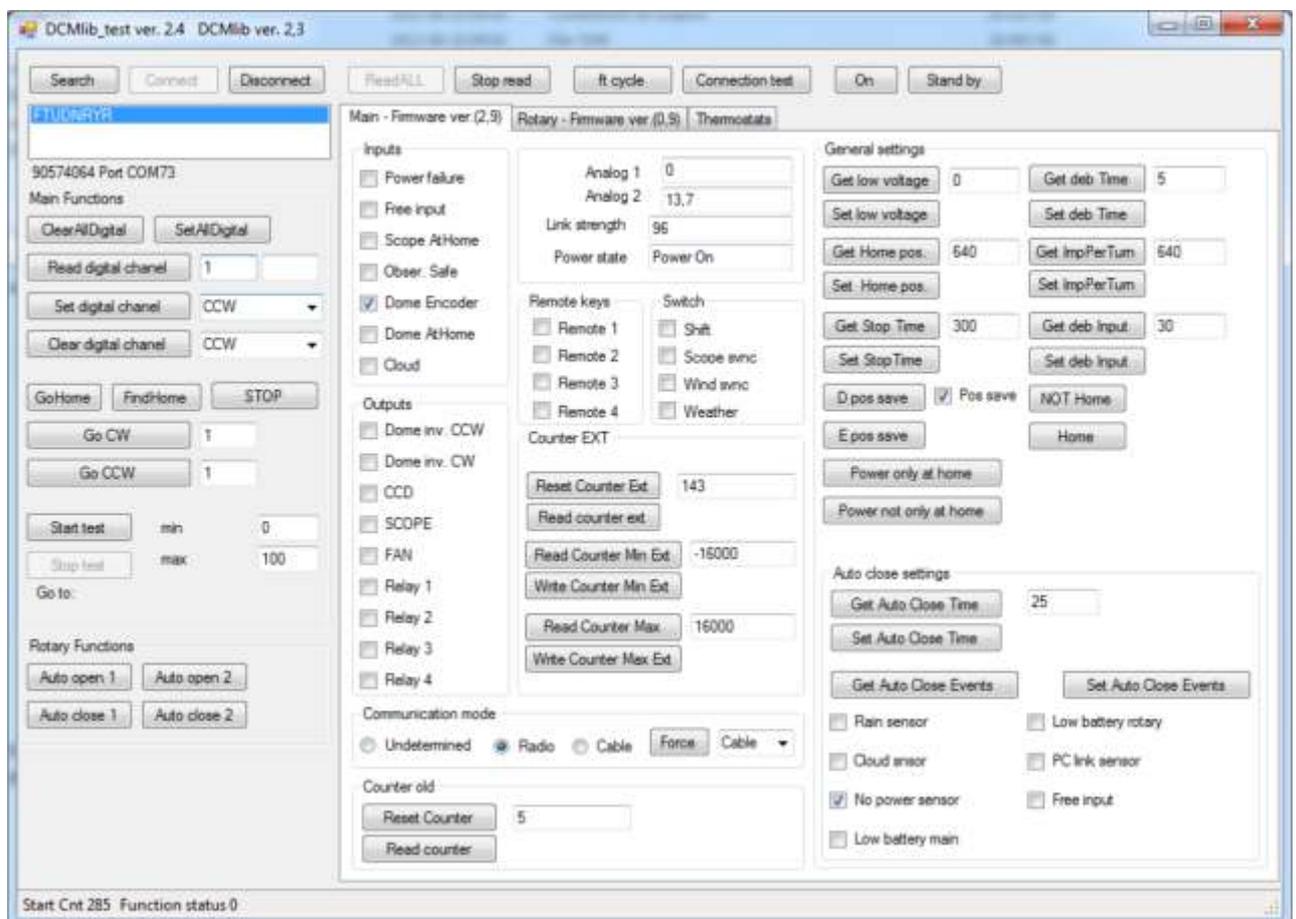
How to check proper operation of limit switches?

After connecting the limit switches according to the scheme, you must turn on the card and check their work but necessarily before you connect the engines. When you press the limit switch connected to the "Open 1 Sensor", its LED on the card panel should light up. Similarly, when you press the limit switch connected to the "Close 1 Sensor", its LED on the card panel should light up. Then we can connect the engines driving the shutter and check if manual pressing the limit swithes arms stops them.

How to check a proper operation of weather sensors and other sensors?

- Disconnecting 230VAC cable from Line 230V input should cause that "No Power" LED lights up
- Activation of "Cloud Sensor" input should cause that "Cloud" LED lights up
- Activation of "Rain Sensor" input should cause that "Rain" LED lights up
- Activation of "Free Input" input should cause that "Free Input" LED lights up
- Activation of "Scope AtHome" input should cause that "Scope AtHome" LED lights up

fig. 13 ScopeDome USB Card Test Application



11. Programming the radio connection between the card components

The card comes with a properly configured radio connections between its components. If the radio connections does not work, use the following instructions.

To start programming for radio connections between components of ScopeDome USB Card ver. 2.0, switch it into StandBy mode. It is also good to set both parts of the card so as to divide them as the smallest distance.

After turning on the card it automatically sets into "Power On" mode. Press „Power On/Off" button to go to StanBy mode.

Programming the radio connection with remote control:

1. Before programming, disconnect the power from moving part of the card.
2. Check if the remote battery is installed.
3. Press "Power On / Off" button on the control panel to set the card in "Standby" mode. Entry into StandBy mode is indicated by red LED lighting up next to "Power On / Off" button and by turning off the alphanumeric display on the card.
4. Press and hold for about 5 seconds "FN" button on the card – until green LED lights up close to it.
5. Press any button on the remote control. Correct programming of the radio connection is indicated by displaying numbers from 1 to 4 on the alphanumeric display on the main part of the card. Info: The card can be controlled using the four remote controllers after their previous programming.
6. Proper operation of the remote control can be checked after turning on the card. After pressing the button on the remote control a proper LED should light up next to corresponding CW, CCW, Open, Close buttons on the main card part.

ATTENTION

BEFORE PROGRAMMING THE RADIO CONNECTIONS BETWEEN SUCCESSIVE REMOTE CONTROLERS OR MOVING PARTS OF THE CARD, TURN ON AND TURN OFF THE MAIN PART OF THE CARD.

Programming the radio connection with the moving part of the card

1. Turn the main part of the card into StandBy mode
2. Connect the power to the moving part of the card
3. Press and hold the „FN" button until green LED lights up
4. After opening the casing of the moving part press a small black button that is located close to the transformer
5. After a while a number from 1 to 5 should appear on the LCD screen. It indicates that there is a connection between the main and the moving part of the card
6. Proper work of the moving part can be checked by pressing „LIGHT" button on the main part. There should be also a characteristic „click" sound audible from the moving part of the card.

Reseting the radio connection system

1. Turn the main part of the card into StandBy mode
2. Press and hold the „FN" button until green LED lights up
3. Press and hold the „STOP" button

12. Firmware Upgrade

ATTENTION

DURING INSTALLATION OF THE NEW FIRMWARE ALL YOUR CARD SETTINGS ARE RESET SO THERE IS A NEED TO CONFIGURE THEM AGAIN. TYPICAL PARAMETERS NECESSARY FOR THE PROPER OPERATION OF THE CARD, WILL BE SET AUTOMATICALLY WHEN YOU FIRST RUN SCOPEHOME USB DRIVER VER 2.0. CONTROL SOFTWARE. TO PRE-PROGRAM THE CARD YOU HAVE GO TO "CONFIG" WINDOW OF THE DRIVER AND ENTER THE RADIUS OF THE DOME, THEN SELECT THE TYPE OF CARD IS CONNECTED, AND THEN PRESS THE "RESTORE DEFAULT". AFTER THAT CLOSE THE CONFIGURATION WINDOW BY PRESSING "SAVE SETTINGS". IF YOU PREVIOUSLY HAD AN OBSERVATORY WITH INSTALLED AND CONFIGURED SCOPEHOME USB CARD AND SCOPEHOME DRIVER - AT ITS FIRST RUN ALL YOUR SETTINGS WILL BE RECONSTITUTED.

Together with the driver on the CD-Rom we provide the latest firmware.

It can also be downloaded from the website: ScopeDome.com (download section).

Firmware is located in subdirectory:

„Software\Card_Firmware\ScopeDomeUSBCard_ver_2.0\ver. 2.7”

„Software\Card_Firmware\<Card_Type>\<Firmware_Version>”

In “Main” and “Rotary” subdirectories you can find the firmware latest version.

It is necessary to begin installing firmware starting from the moving part of the card "Wireless Shutter Control Module".

Firmware upgrade of „Wireless Shutter Control Module”

The installation shall take about one minute.

1. Turn on the power of the card
2. In Control Panel set the virtual COM port associated with ScopeDome USB Card into the port from the range of COM1 – COM4.
3. Make sure that the radio communication between the main and moving part of the card is stable.
4. Run "Update Rotary.Bat" batch file from "Rotary" subdirectory
5. Follow the instructions displayed on the screen
6. When you install the firmware on LCD screen on the card displays the message "FLA.". Computer screen displays the installation progress indicator (the line of characters "#").
7. After correct firmware installation on the moving part computer screen displays the words "Equal! Leaving programming mode ...", and LCD screen on the card displays "0" (zero).

In case that firmware upgrade fails, you must repeat it. The most common cause of trouble with the upgrade is a poor quality of the radio connection. If after several attempts the installation still fails, you can try to turn the card into a firmware programming mode. To do this you shall:

1. Disconnect the power from the moving part of the card
2. Open the casing of the moving part of the card
3. Press the small black button that is located close to the transformer and holding it connect the power to the moving part of the card
4. Run "Update Rotary.bat"

Firmware upgrade of the main part of the card

The installation will take about a minute.

1. Turn on the power of the card
2. In Control Panel set the virtual COM port associated with ScopeDome USB Card into the port from the range of COM1 – COM4.
3. Run "Update Main.Bat" batch file from "Main" subdirectory
4. Follow the instructions displayed on the screen
5. When you install the firmware LCD screen on the card displays nothing. Computer screen displays the installation progress indicator (the line of characters "#")
6. After correct firmware installation on the main part computer screen displays the words "Equal! Leaving programming mode ...", and LCD screen on the card displays "0" (zero).

13. Additional functions of the alphanumerical LCD screen

Access to additional display functions can be obtained after holding for a few seconds "Shift" button - until the moments when the display shows P0. Then, pressing Open/Close buttons we can change the parameter number we wish to see. To display its value, press "Display" button. After you press "Display" button again, you go back to the previous list of parameters. To exit the preview card parameters mode, please double-press "Power On / Off".

Additional parameters displayed on the card:

- P1 - the value of the main encoder counter AZ - not cleared during passage through the Home Sensor
- P2 - the value of the auxiliary encoder counter AZ - cleared during passage through the Home Sensor
- P3 - lower limit of the dome position encoder counter
- P4 - upper limit of the dome position encoder counter
- P5 - CounterDebounceTime – minimum time of an incoming pulse from the encoder
- P6 - number of encoder pulses per one rotation of the dome
- P7 - Link status % - radio signal strength indicator
- P8 - home sensor position – position of HomeSensor in degrees
- P9 - encoder counter value for the shutter no. 1
- P10 - encoder counter value for the shutter no. 2
- P11 - voltage of the battery that powers the moving part of the card at which it will automatically close the shutter

14. Error codes reported by the card

All errors reported by the card are stored in the logs of the computer program.

Errors reported by the virtual COM port:

- 0 - the card is working properly
- 1-10 - errors caused by Ft232
- 19 - lack of communication between USB port and the card (FT_READ_TIMEOUT)
- 20 - error when sending data via USB port (FT_WRITE_TIMEOUT)
- 21 - lack of authorization by the card at connection initialization (FT_AUTHORISATION_ERROR)
- 22 - incorrect checksum of received packet (FT_CHECKSUM_ERROR)

Errors reported by the ScopeDome USB Card:

- 31 - incorrect checksum of received packet
- 32 - error in the header of a received frame
- 33 - incorrect command code (suggested card software update)
- 34 - wrong parameter when calling the function from the library
- 35 - wrong parameter when calling the function from the library
- 36 - error returned when trying to quickly change the direction of the dome without its first stopping and waiting time defined in the 'Dome Stop Pause'

15. Wiring diagrams for typical 3Phase engines

The card can be used in so many ways that all possible diagrams of the observatory automation can not be put in one document. Below we discuss only the most typical. Wiring diagrams showing the connection of the card you'll find on the attached CD-ROM in "Electrical Diagrams" directory. You can also download them from our site <http://www.ScopeDome.com>.

The most typical diagram (used by us in PlugAndPlay option) showing the connection of the card you will find in the file: "Observatory_Block_diagram_With_Plug_And_Play_Wiring_Card_2.0.pdf" (look at connection diagram on page 16,17,18 and 19))

16. Alternative methods of connecting Home Sensor and the encoder

Any home sensor or encoder supplied by other manufacturers or self-made can be connected to the card. The only condition is to keep a short-circuit between OS and GND inputs of the encoder or Home Sensor. Depending on which state of Home Sensor is active, it may be necessary to negate it during the card configuration procedure. To do this, select Config> CardConfig.> Negative HomeSensor. For example, this option should be selected when Home Sensor function is fulfilled by the contactron joints. (look at connection diagram on page 20)

17. Remote hardware reset of the card power supply

If you use the card at the observatory controlled remotely (unmanned) - we believe it is necessary to use additional physical systems for remote power on and off the card and PC (the control computer). Remember that for various reasons microprocessor card may crash or we can lost radio contact with the movable part of the card. The best solution in this case are wireless power switches controlled via the Internet by WiFi. For example, it can be: Aviosys IP POWER 9258 Wi-Fi Remote Power Switch - 4 Port ([link](#)). To wireless control the power of the moving part of the dome a WiFi router is also essential. (look at simplified scheme with a switch and router on page 21)

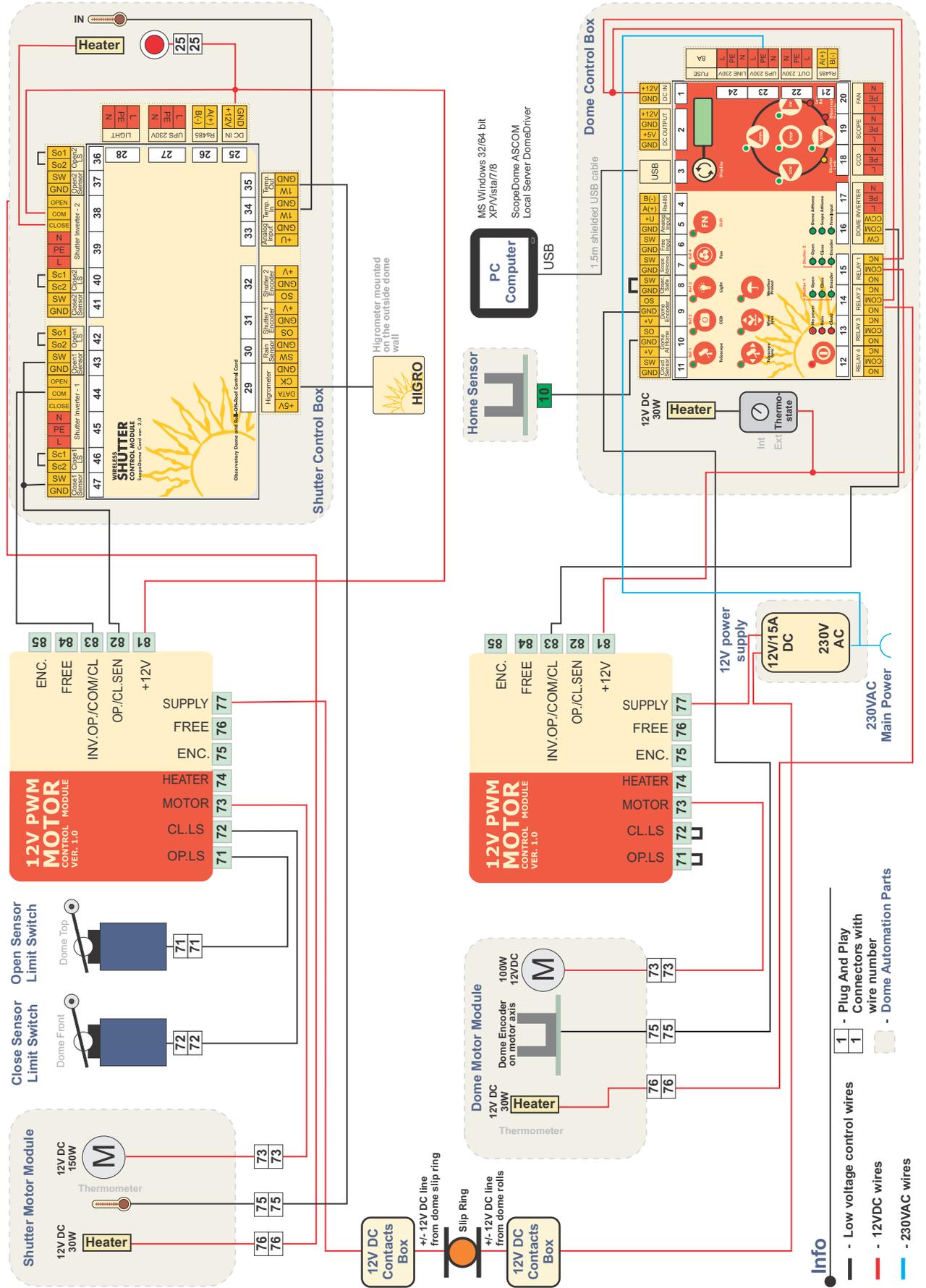
Cheap, simple, and often helpful solution, in the case of loss of communication with the moving part of the card - is to use one of the relays, eq. REL1. You can use it to disconnect power from the main part of the card for a moment. After remote turning on REL1 relay, the card power is disconnected. The card is turned off for a moment, and thus the relay returns to its resting position and the power of the card is turned on again. After rebooting the driver we may regain control of access to the card that is already reset. (look at connection diagram on page 22)

18. Control of 230VAC 1-Phase engines

To connect 230VAC 1-Phase engines there is a need to use additional RelayBox module. (look at 230VAC 1-Phase engine wiring diagram on page 23)

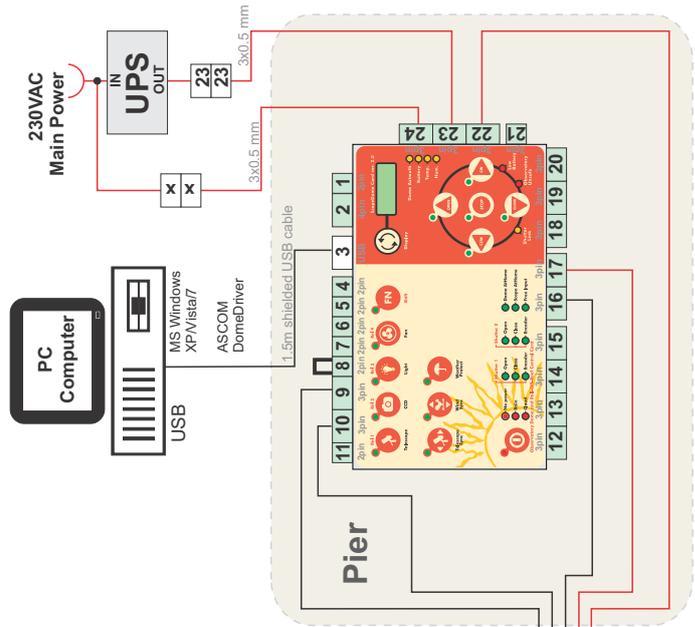
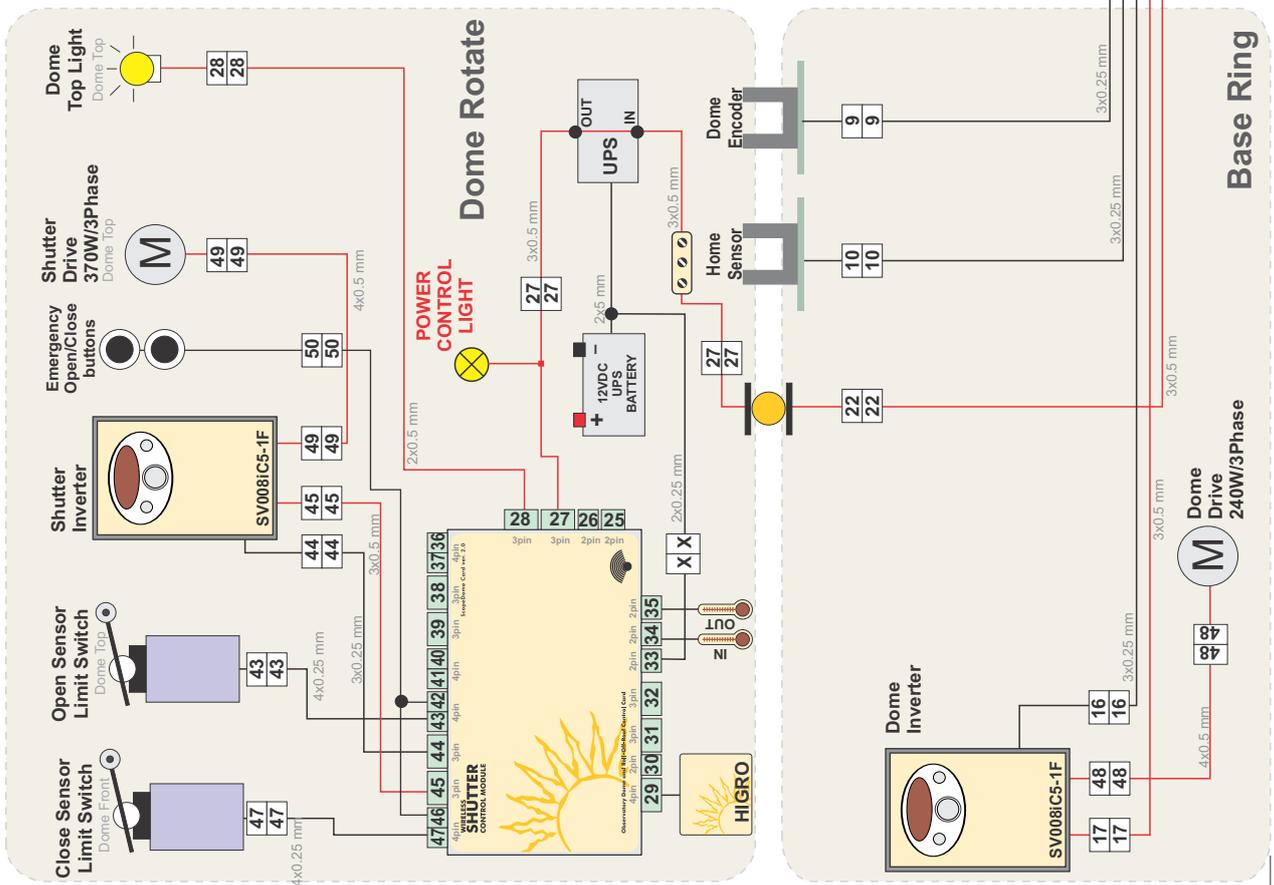
19. Control of 12V DC engines

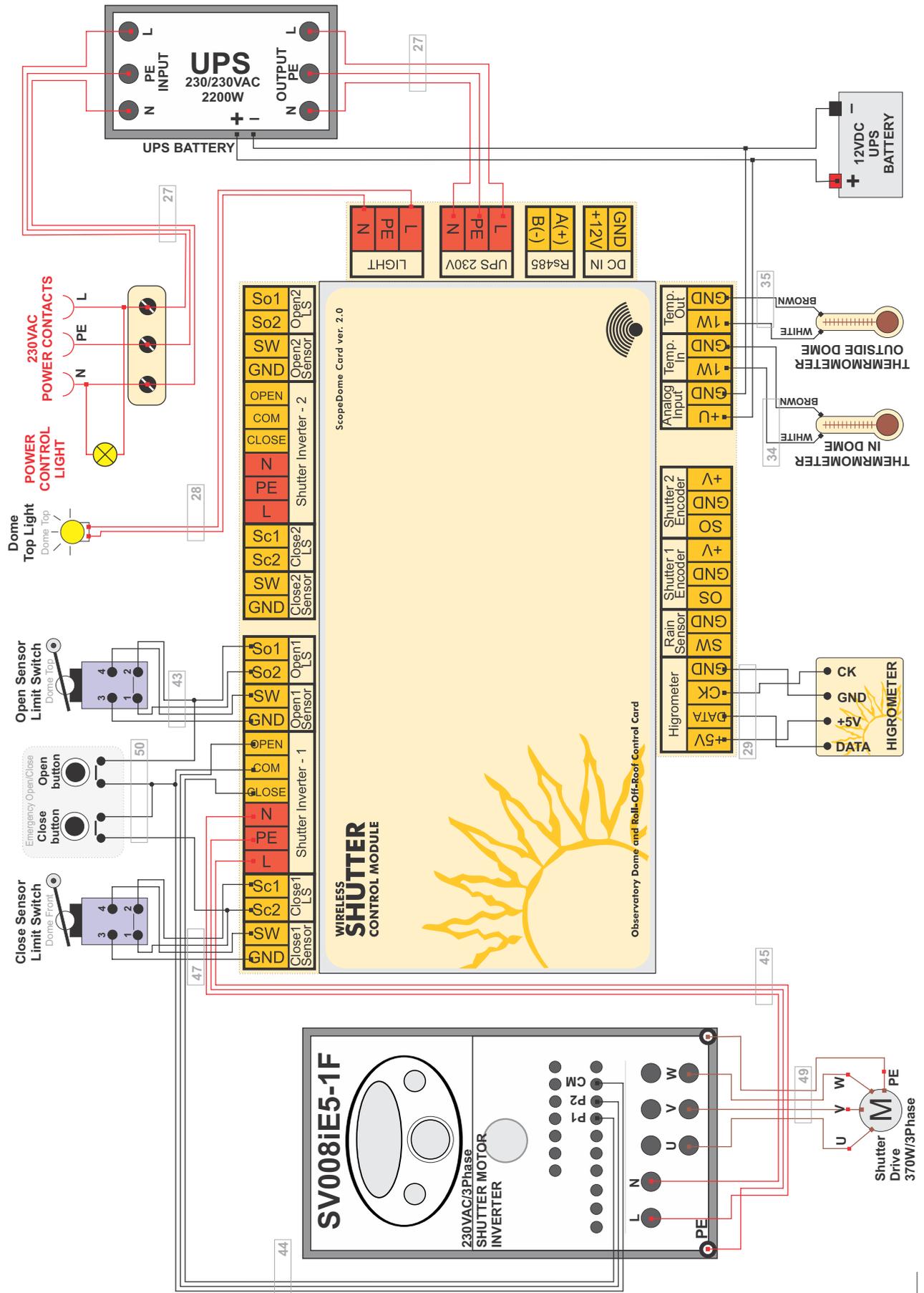
To connect 12V DC engines there is a need to use additional 12V PWM Motor Control Module or ScopeDome CW/CCW to 12V DC RelayBox module. (look on page 16 or 12V DC engine wiring diagram on page 24)

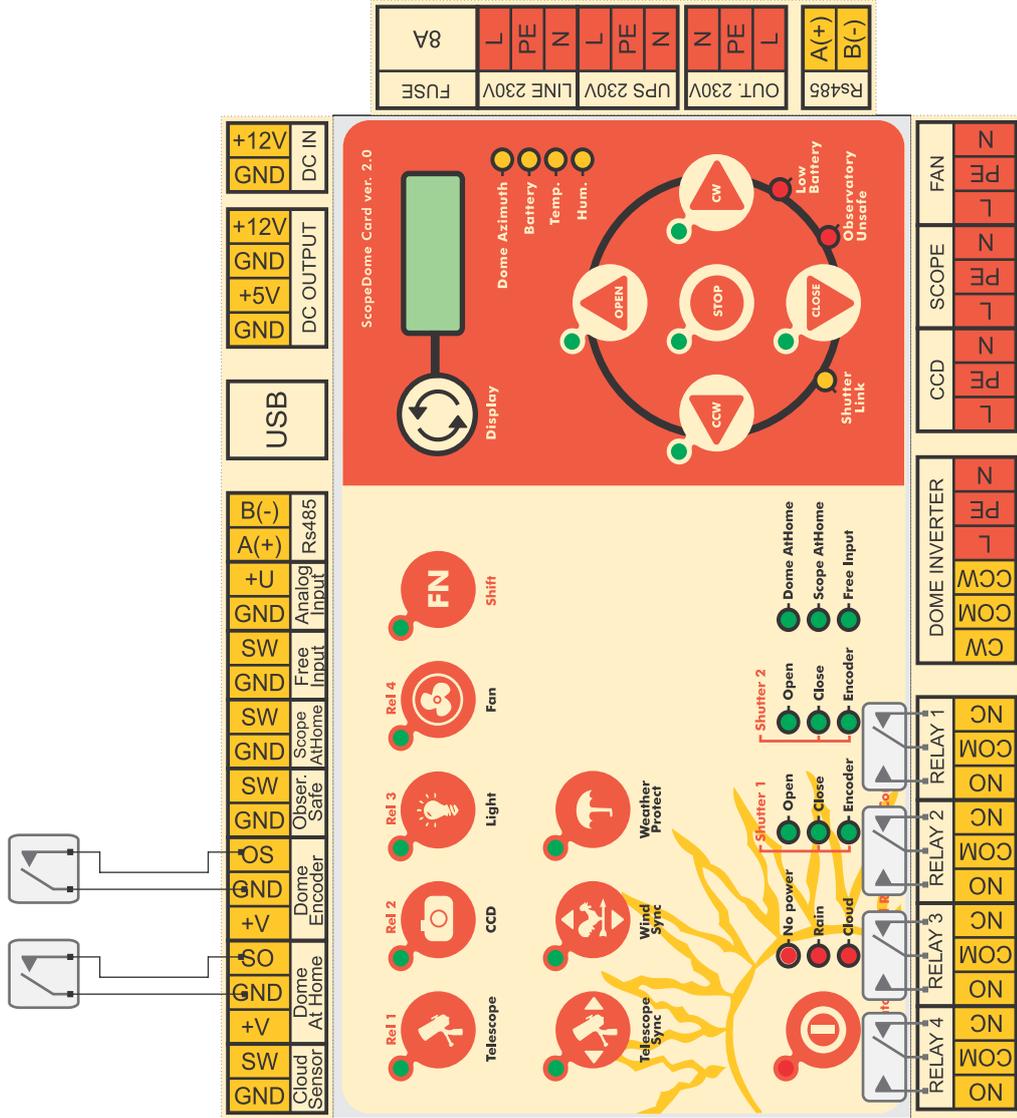


Drawing info

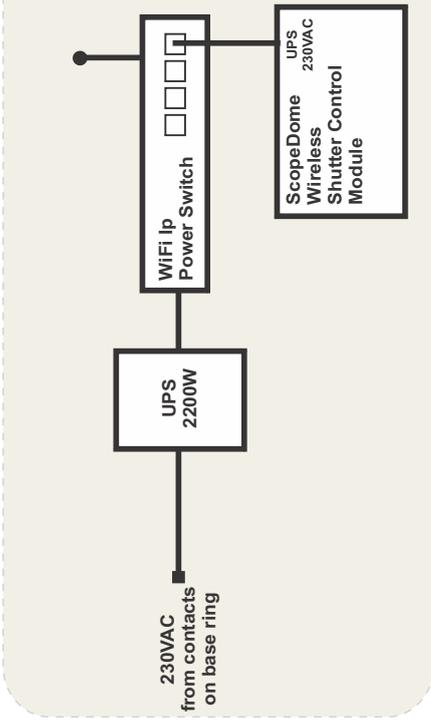
- Low voltage wires
- High voltage (230VAC) wires
- Plug And Play Connectors with wire number
- Dome Parts
- Main Power (230VAC)
- Power Contacts on basring
- Main power connector on dome rotate part





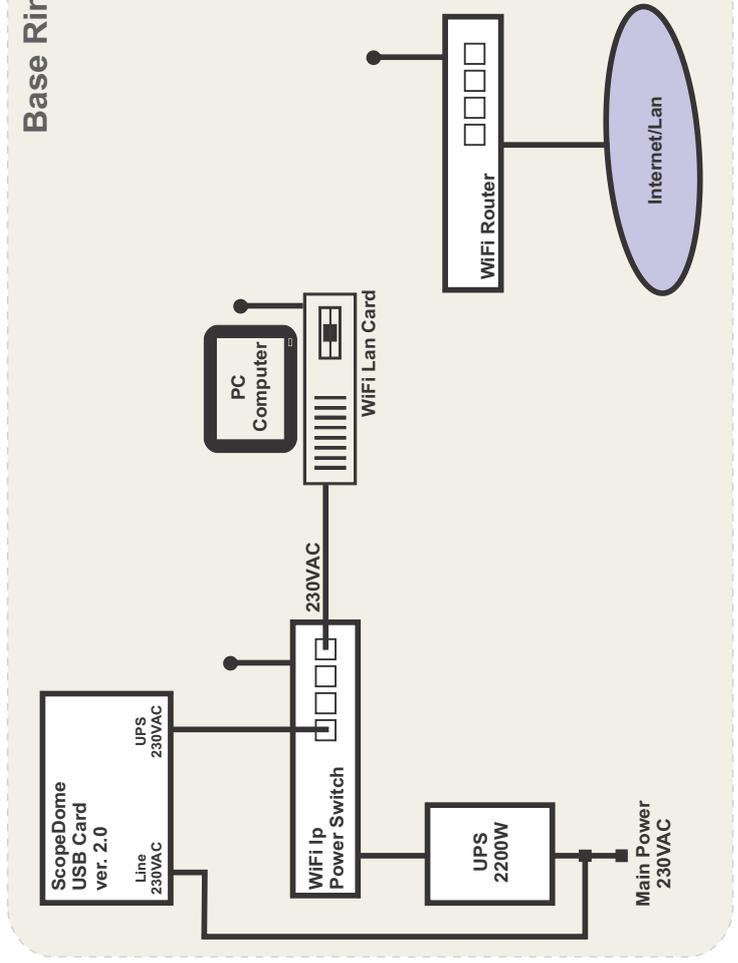


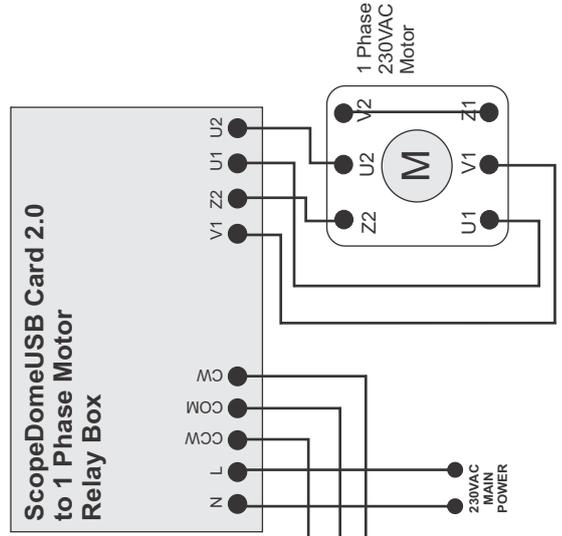
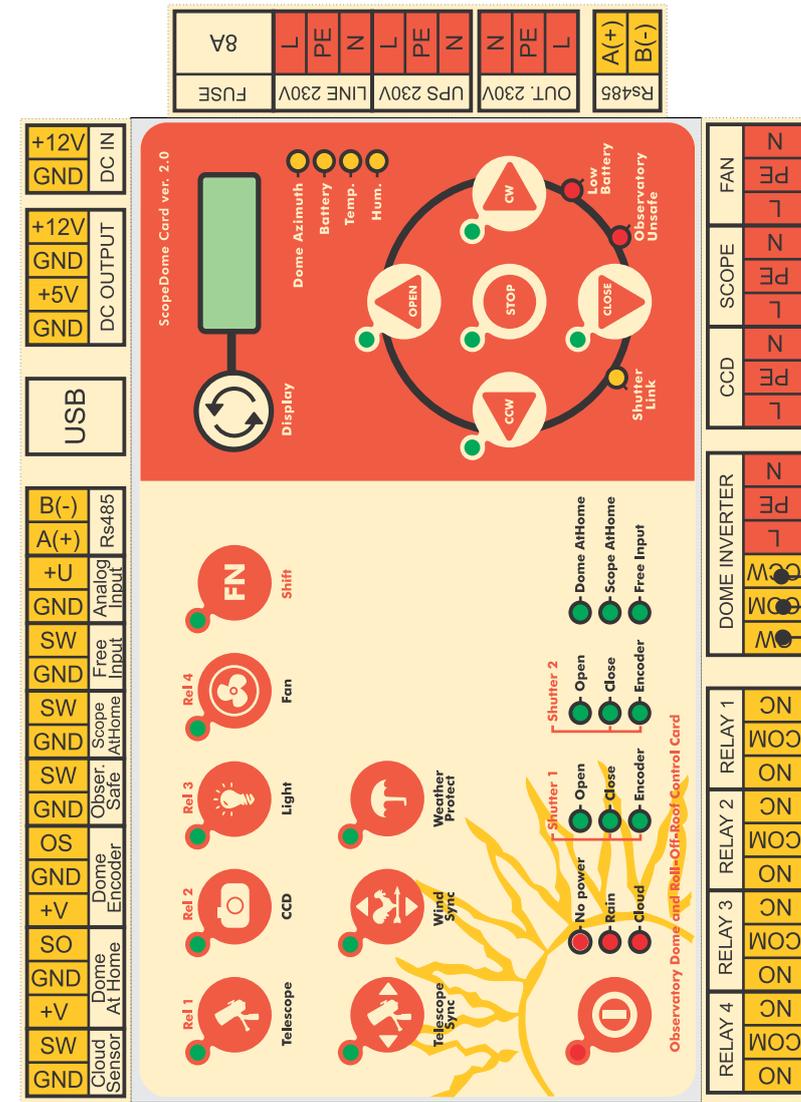
Dome Rotate



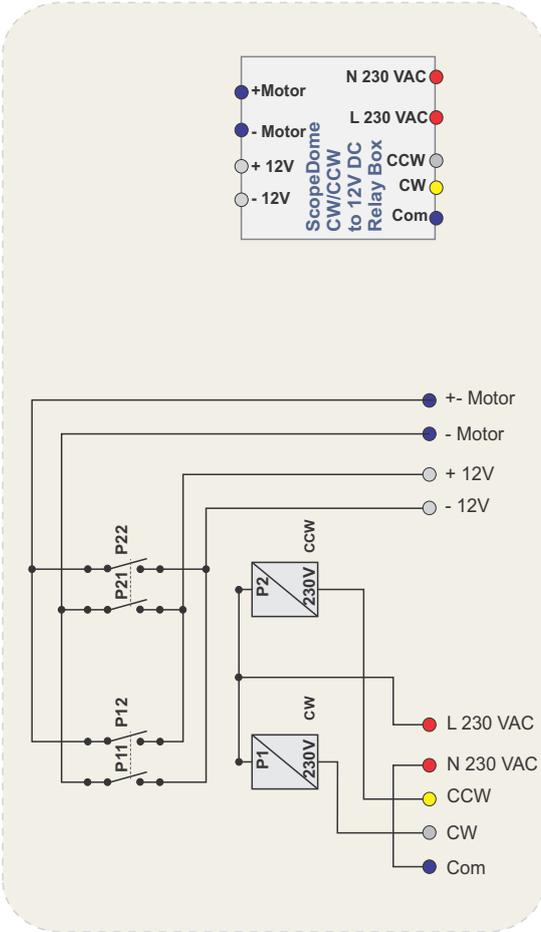
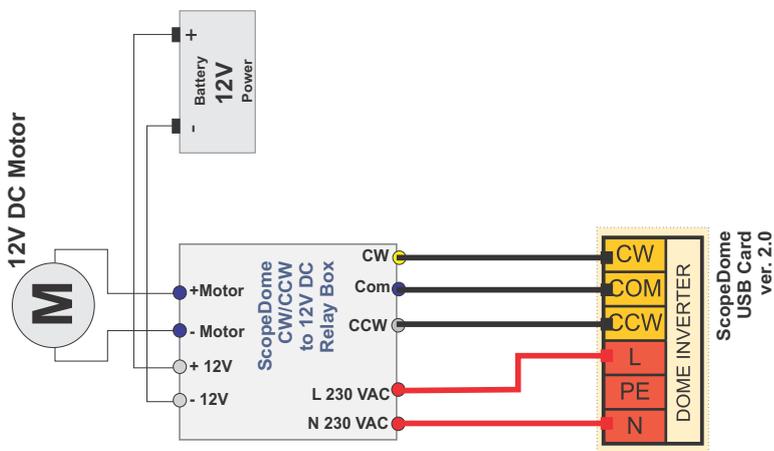
Aviosys IP POWER 9258
Wi-Fi Remote Power Switch
- 4 Port

Base Ring





Main ScopeDomeUSB Card 2.0 to 1 Phase Motor Relay Box Connection Diagram

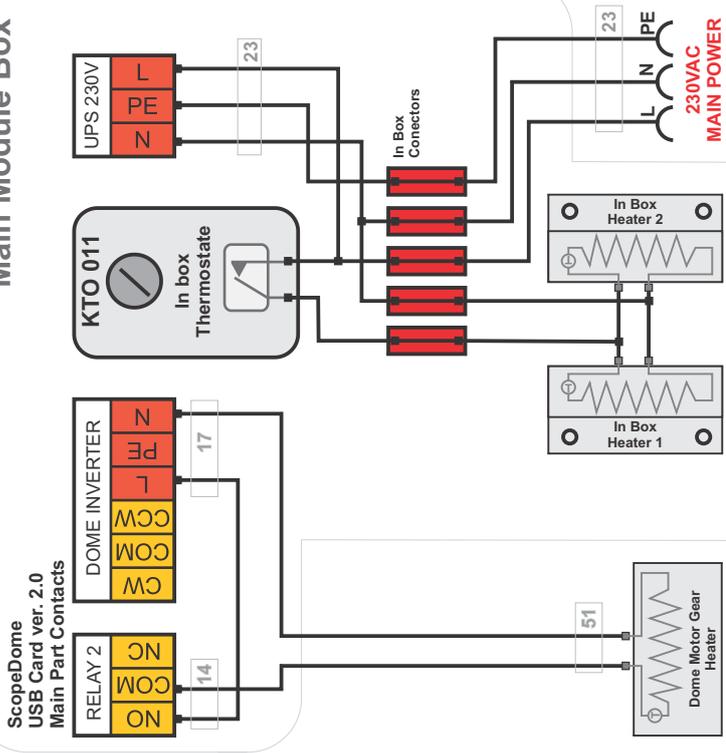


ScopeDome CW/CCW to 12V DC Relay Box

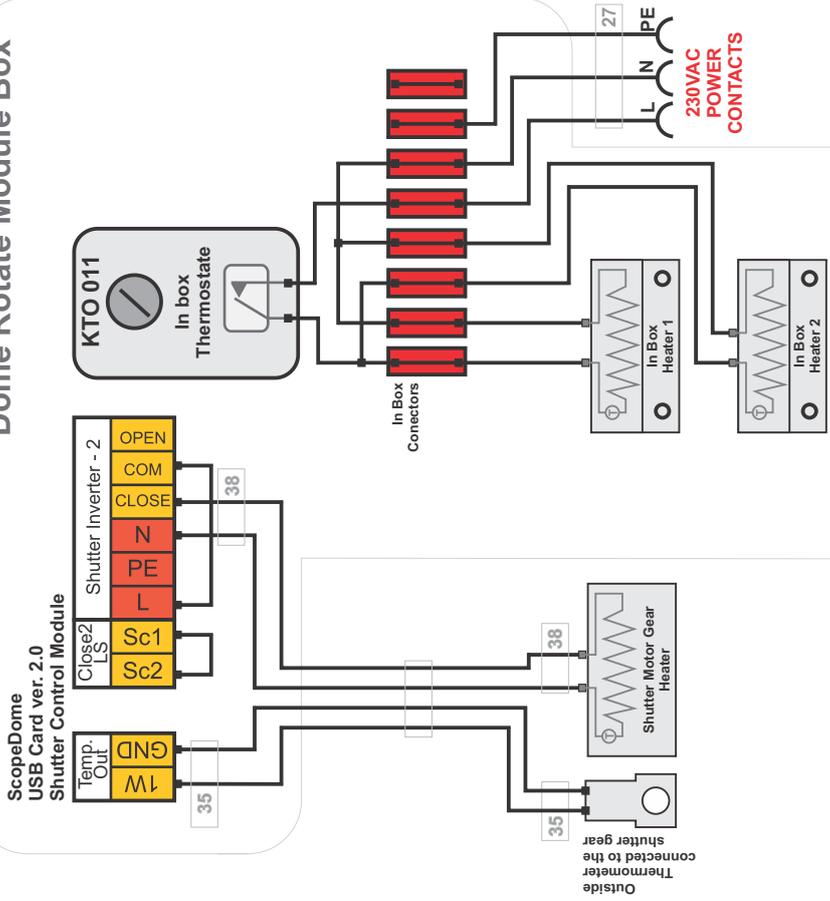


230VAC Heating system for ScopeDome card

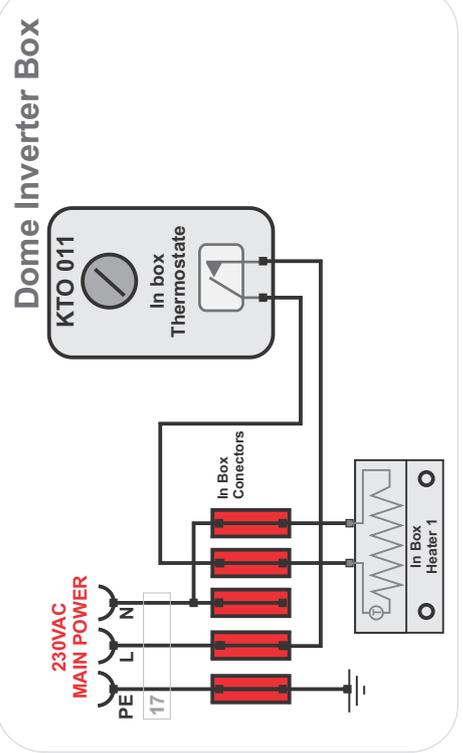
Main Module Box



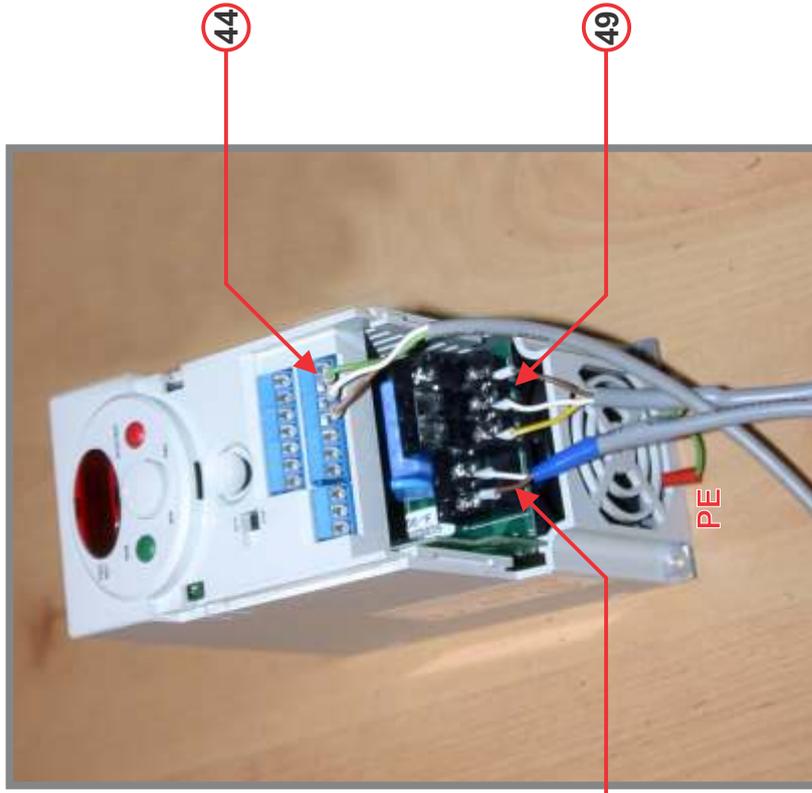
Dome Rotate Module Box



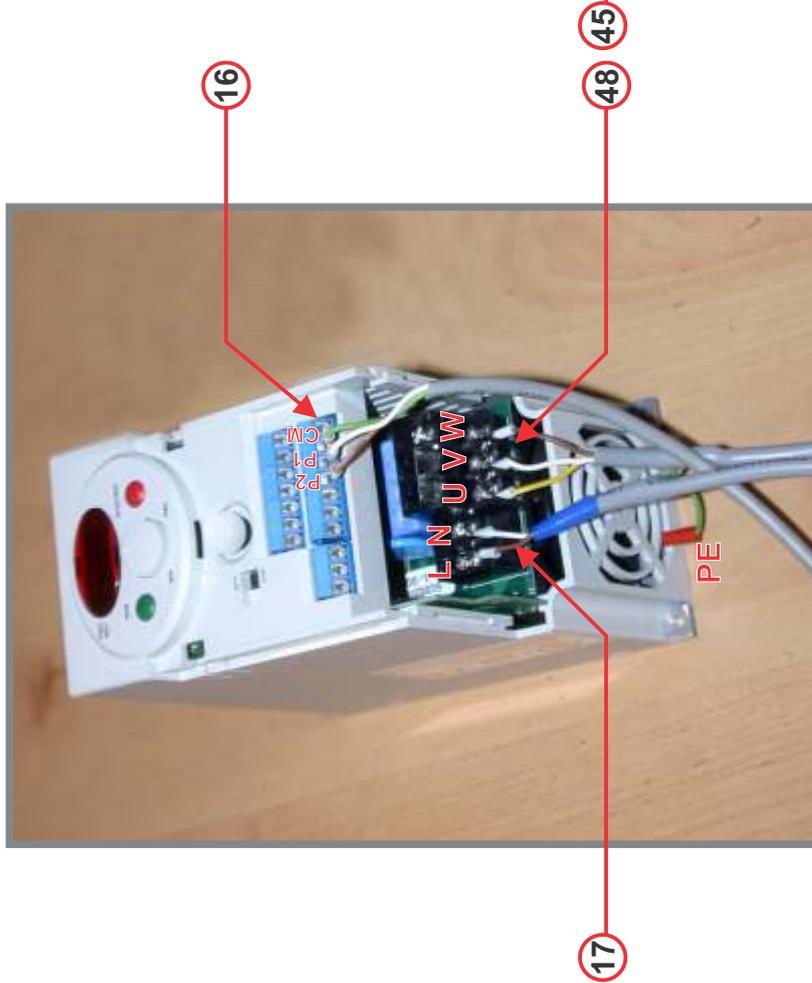
Dome Inverter Box



Shutter inverter connection



Dome inverter connection



230V AC (Power)

L N

To ScopeDome Card

P1 P2

CM

To 3 Phase Motor

U V W

PE

