DREAM 2
Irrigation Control Systems
INSTALLATION GUIDE

GOLDTEC
CONTROL SYSTEMS

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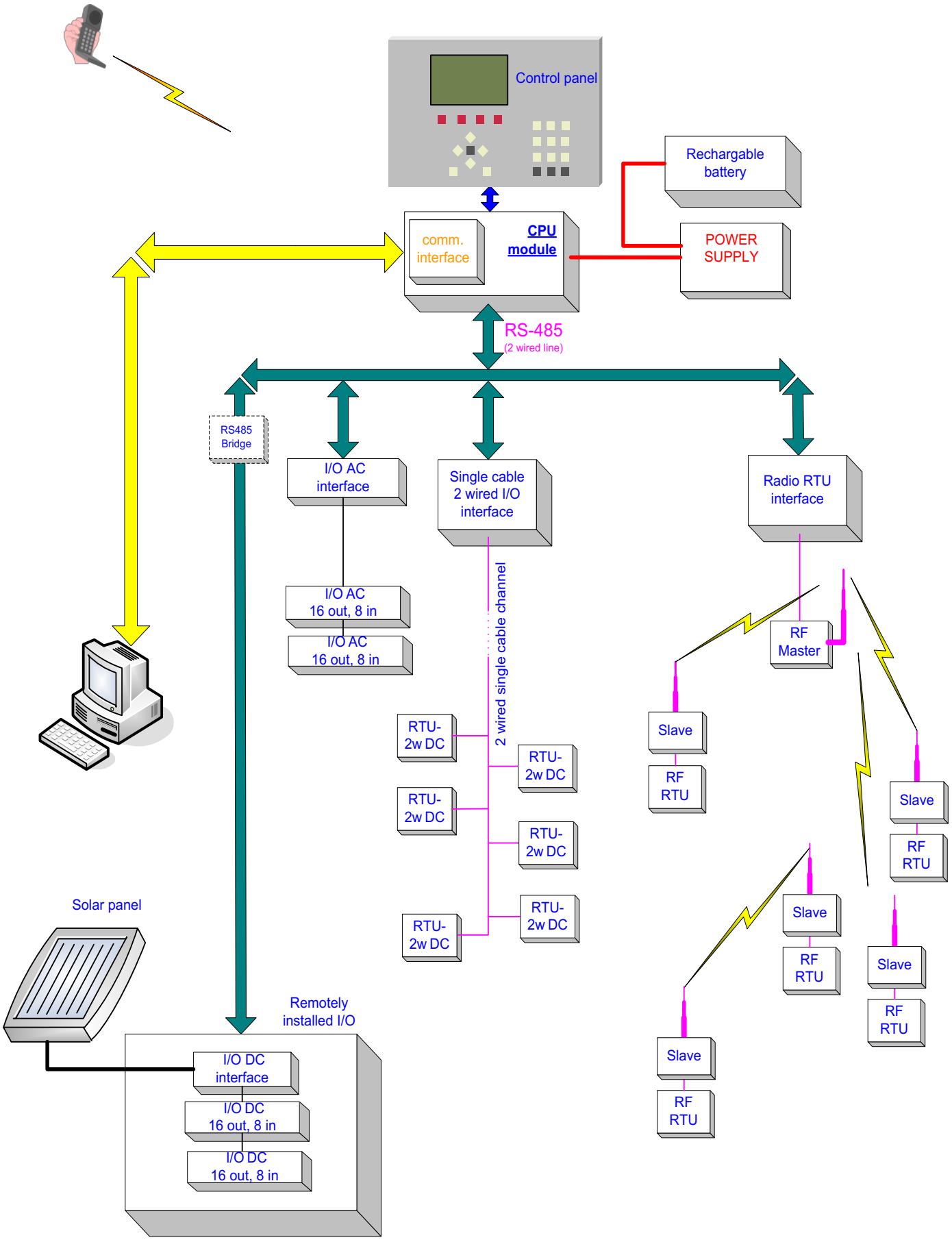
CONTENTS

THE SYSTEM STRUCTURE

The following schematic diagram describes the principal structure of the DREAM 2 system.



THE FLEXIBLE CONSTRUCTION OF THE DREAM 2 SYSTEM

The activities of an irrigation control system depend very much on its ability of reading **I**nputs and executing **O**utput commands while the **I/O** devices to be connected to the system (valves, water meters etc…) may sometimes be close to the controller and sometimes far away. Sometimes they are concentrated in one place and sometimes distributed. Sometimes they can be reached by cable and sometimes cable is out of the question. The DREAM 2 has answers for all these cases.

The heart of the system is the **CPU module**, which contains all the programs and the necessary information for controlling all activities of the irrigation system. The CPU uses various types of **I/O interfaces** for communicating with the various types of I/O executives that will be chosen according to the specific requirements. Therefore the construction of the DREAM will vary accordingly.

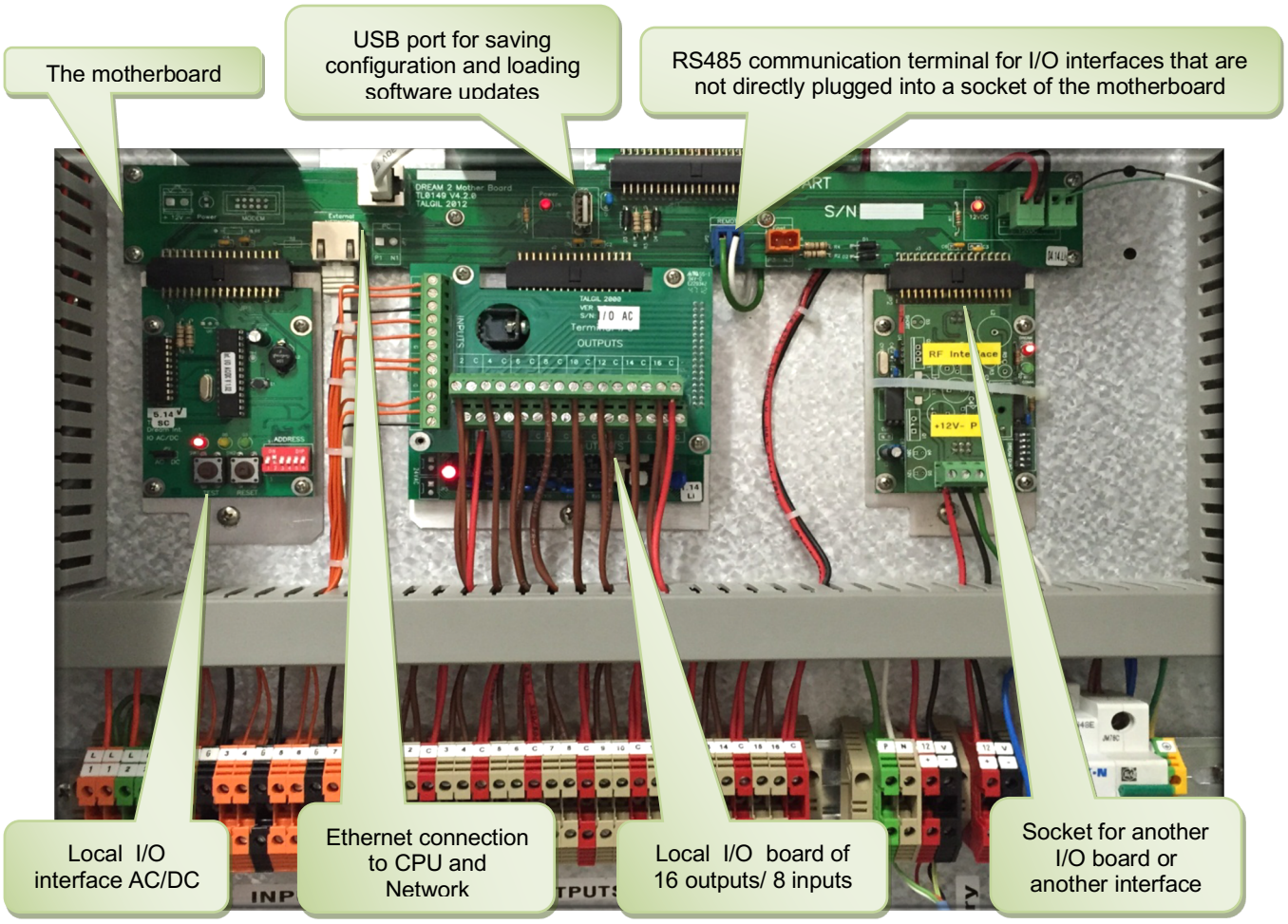
The above diagram demonstrates the fact that the DREAM 2 system may be constructed by a flexible combination of various Input / Output executives, which can give the right answers in each particular case.

THE VARIOUS I/O OPTIONS

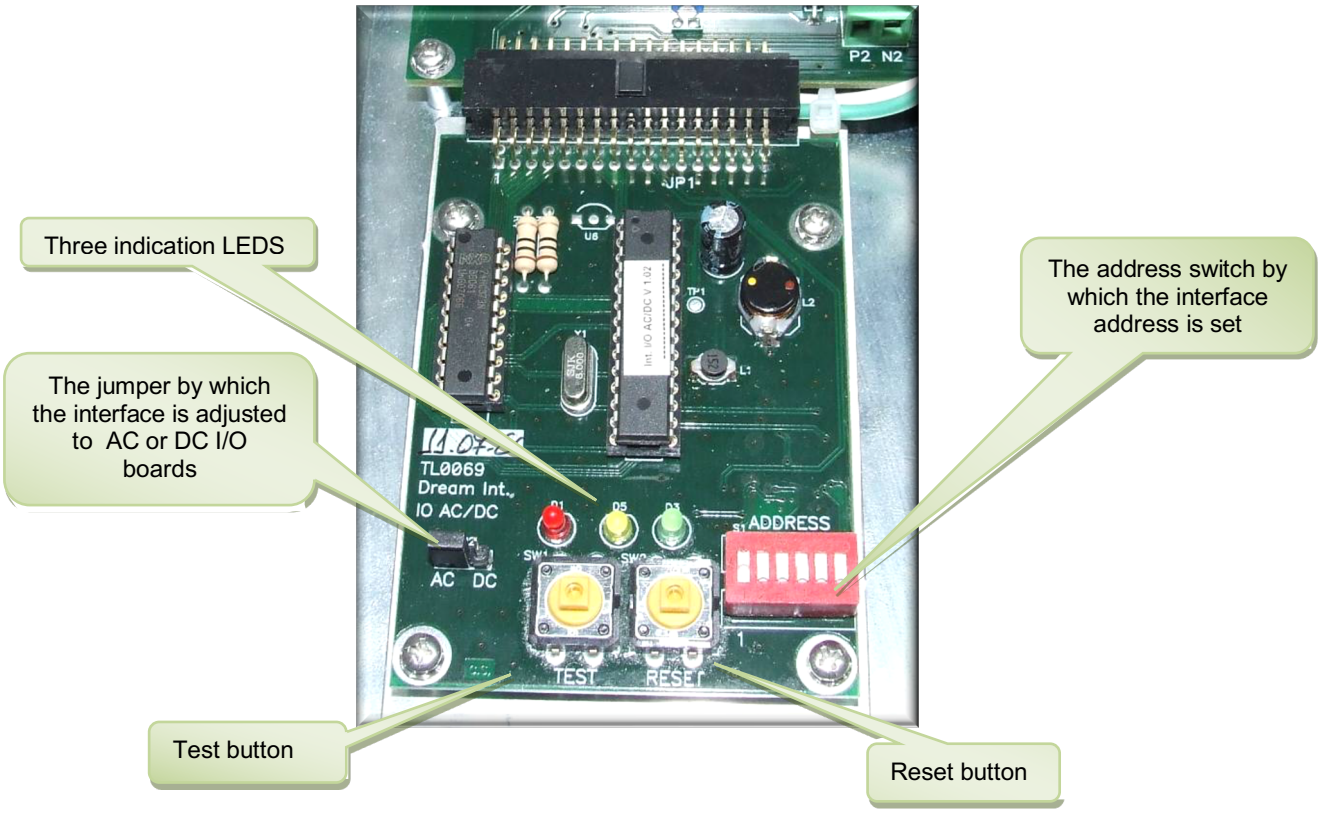
The various I/O options will be discussed by describing the various I/O interfaces recognized by the DREAM system:

INTERFACE FOR LOCAL I/O AC OR DC

Suitable for reading digital inputs and activating local outputs, which are in the close proximity of the DREAM 2. The interface may control 1 or 2 boards of 16 outputs and 8 inputs.



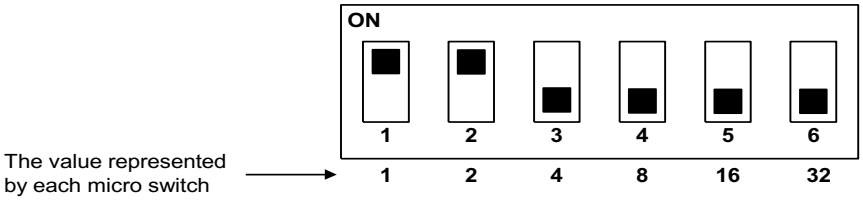
Let's have a closer look on the local I/O interface:



The AC / DC selection jumper must be set according to the type of I/O boards used. Naturally AC I/O can only be used when there exists constant supply of electricity.

Each interface in the system will have a unique address. The address switch must be set to the address selected for the particular interface. This address will be later introduced to the DREAM 2 software during the configuration process.

The addressing uses a binary coding as explained below:



The micro switches are numbered 1,2,3,4,5,6. Each micro switch according to it's ordinal number represents a value between 1 and 32 as shown above. The address is calculated by summing up the values of the micro switches that are in the ON position. Appendix "A" supplies a conversion table from binary to decimal that shows the setting of the switches required for each address.

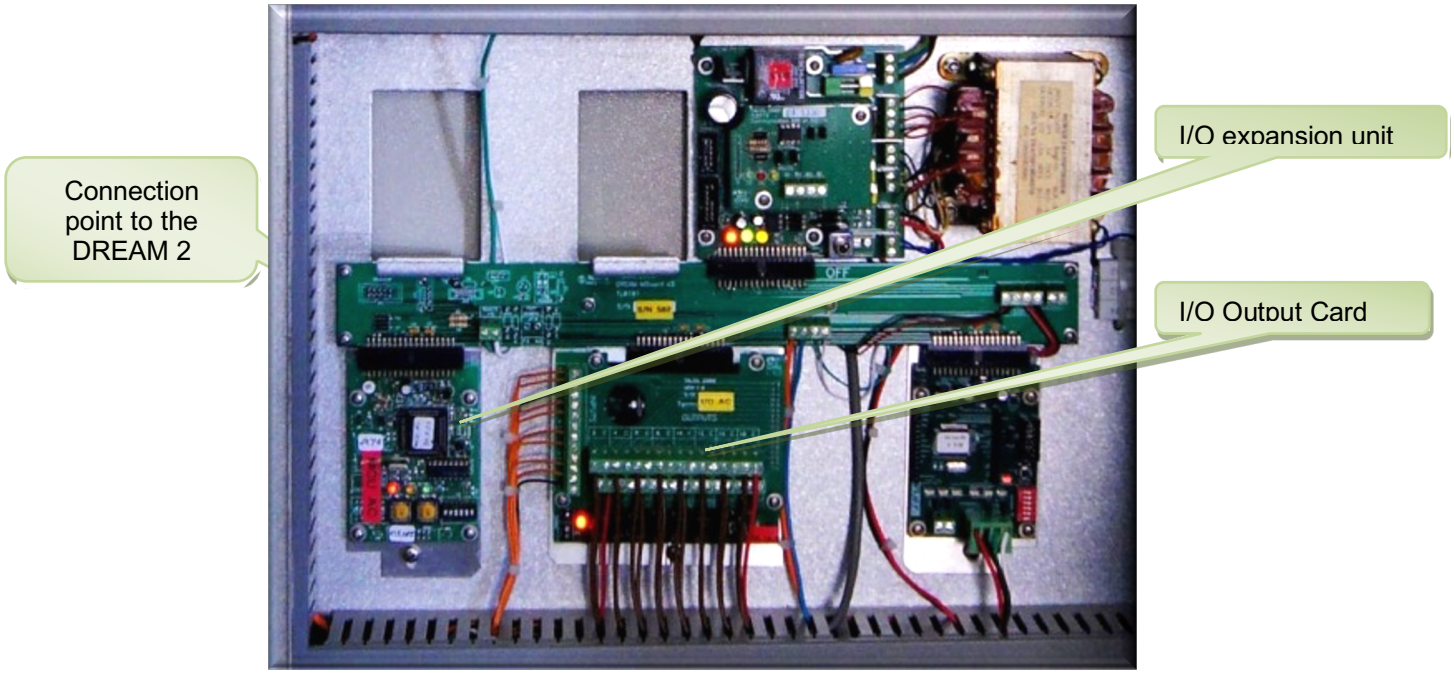
The red LED 🔴 indicates the communication between the CPU and the interface. When the communication functions properly, the red led will blink a short blink each second.

The yellow and green LEDs serve the I/O test mode. After pushing the test button, the interface goes into the I/O test mode. When the yellow LED 🟡 is constantly ON the outputs are tested, each output will be opened and closed, each opening and closing will be indicated by a blink of the green LED🟢. During the inputs test the yellow LED 🟡 will blink once per each input being tested and if a closed contact is detected, the red LED 🔴 will blink as well.

I/O expansion local and remote

The **motherboard** of the DREAM 2 may accommodate one interface, two local I/O boards and no more, therefore the maximum number of outputs, and inputs inside the enclosure are limited. The outputs cannot exceed 2 x16 = 32 and the digital inputs cannot exceed 2 x 8 = 16. When this is not enough, an **I/O expansion unit** must be used. The I/O expansion unit will contain the local I/O interface, the I/O boards, a motherboard**,** and a power supply, which may be AC or DC depending on the availability of electric source.

The I/O expansion unit can be installed remotely from the DREAM 2 and then it will be called **remote I/O expansion unit**, which becomes very useful when there is a concentration of a large number of I/O devices located away from the DREAM 2. The following picture shows a remote I/O expansion unit which is powered from the mains and contains a DC I/O interface and one 16/8 DC I/O board. The connection to the DREAM 2 will be by a 2 wired cable connected at the terminals on the motherboard allocated for the remote I/O RS485 communication. Notice the marking P2 and N2 on the motherboard, which indicates that the communication line has a polarity, P2 is for the positive wire and N2 for the negative one. At the DREAM2 side, the connection will be through a **Bridge** board which is a special board for connecting remote interfaces (see the explanation below about SPECIAL ACCESSORIES).

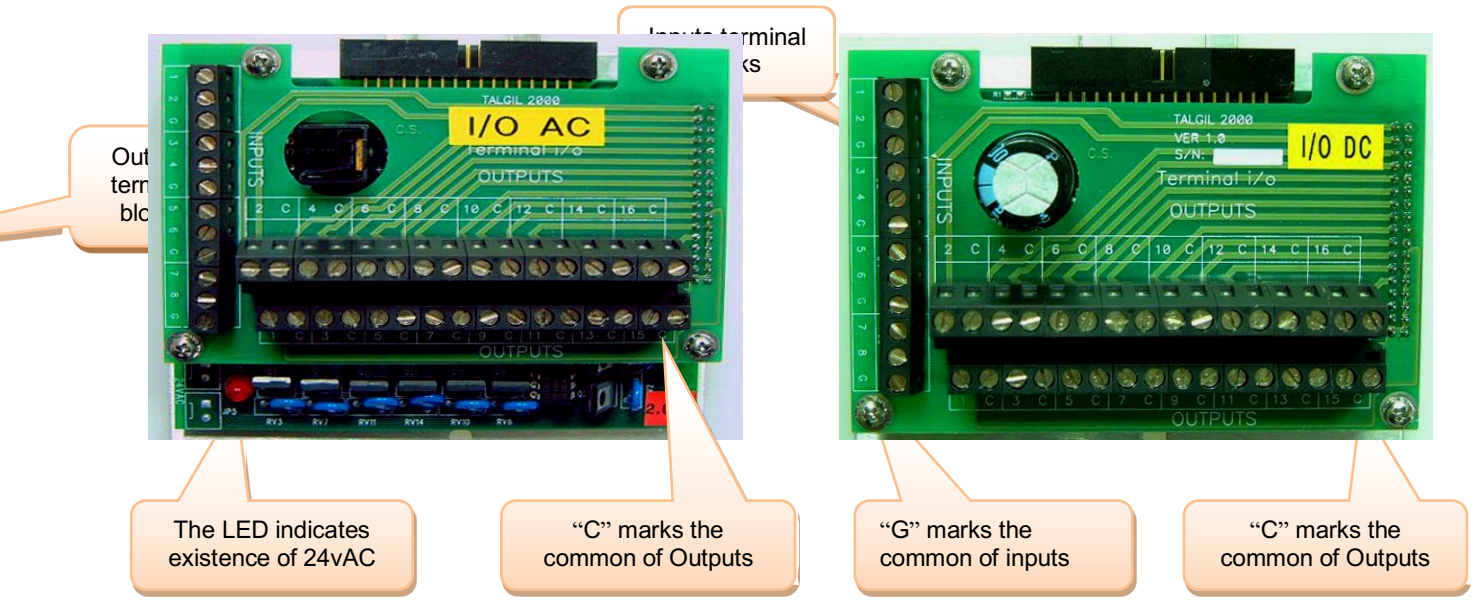


Beware of the polarity !! the RS485 communication line has a positive wire marked "P2" and a negative wire marked "N2". Do not confuse between them.

A few facts about inputs, outputs and connections to the I/O boards:

Digital Inputs

- The digital inputs receive dry contact sensors; therefore, they have no polarity.
- Each input is connected to the I/O board by 2 wires that may be interchanged.
- Several inputs may share one wire as common; this wire will be connected to any of the terminals on the inputs terminal block marked by the letter "G" which is allocated for Inputs common.
- Commons of separate I/O boards cannot be interconnected.
- The maximal length of the wire from the I/O board to the input may be 200 meters. The wires should be with a cross section of 1.5mm^2.



AC Outputs

- AC outputs are activated by 24V AC.
- Each AC output is connected to the I/O board by 2 wires that may be interchanged.
- Several AC outputs may share one wire as common, this wire will be connected to any of the terminals on the outputs terminal block marked by the letter “C” which is allocated for outputs common. The thickness of the common wire must take into consideration the number of solenoids to be activated simultaneously and the power rating of the solenoids.
- Commons of separate I/O boards cannot be interconnected.
- The length of the wires from the I/O board to the AC device to be activated may be hundreds of meters long, but the thickness required grows with the distance.
- An output remains activated as long as it is energized.
- Solenoids of normally open valves and normally closed valves will be wired the same way to the terminal board but will differ in the connection of the command tubes and sometimes will differ in their physical structure.
- The voltage measuring of an AC output will be correct only when the output is checked while loaded.

DC Pulse Latching Outputs

- DC latching outputs are activated by pulses of energy and remain in their last position by magnetic means, therefore they are energy saving.
- Each DC output is connected to the I/O board by 2 wires – red and black of which the polarity is important. The terminal block of the outputs contains two terminals per each output, one terminal is marked by the ordinal number of the particular output and the other by the letter “C”. For normally open valves, the black wire will be connected to the terminal marked “C” and the colored wire to the terminal marked by the ordinal number. For normally closed valves, the position of the black and the colored wires should be interchanged.
- Several DC outputs may share one wire as common, this wire will be connected to any of the terminals on the outputs terminal block marked by the letter “C” which is allocated for outputs common.
- Commons of separate I/O boards cannot be interconnected.
- The length of the wires from the I/O board to the DC device to be activated, cannot be long, it differs with the type of solenoid used. The correct distance should be consulted with the manufacturer.
- An output remains activated as long as it does not receive the opposite command.
- The voltage at the DC output cannot be measured by regular voltmeters because it exists for a very short period.

INTERFACE FOR SINGLE CABLE 2 WIRED RTU

When the I/O devices are distributed in a large area (radius of 10 km) and it is possible to lay a 2 wired cable in the field, we shall use the 2 wired RTU system to reach all the remote I/O devices. The RTUs are **R**emote **T**erminal **U**nits, which can read digital or analog inputs and activate DC latching outputs. The RTUs will be placed wherever there are I/O devices to control. There will be a 2 wired cable running from the RTUs like branches of a tree to the root which is the **2W interface** located near the DREAM. Up to 60 RTUs may be connected to a 2W interface. The DREAM may handle several 2W interfaces. Detailed information about the 2W RTU system can be found in the manual "DREAM 2, 2W RTU SYSTEM 2015".

INTERFACE FOR RADIO COMMUNICATED RTU

When remote I/O devices cannot be reached by cable, radio communicated RTUs will be used. The radio RTU interface will communicate with the RF RTUs through an **RF MASTER** receiver/ transmitter located on top of a high pole. In the field, the RTUs will be placed next to the I/O devices to be controlled. Each RF RTU consists of an **RTU BASE** to which the inputs and outputs are tied, and an **RF SLAVE** receiver/ transmitter which will also be installed on top of a high pole. The SLAVES exchange information with the MASTER, each in its appropriate timeslot, dictated by the RTU'S address. It is expected that there will be a line of sight connecting between the antenna of the RF MASTER and the antennas of the RF SLAVES otherwise some RF RTUs can be turned into repeaters for the benefit of their neighbors. Detailed information about the RF RTU system can be found in the manual "DREAM 2 RF RTU SYSTEM GUIDE 2015".

INTERFACE FOR READING ANALOG INPUTS

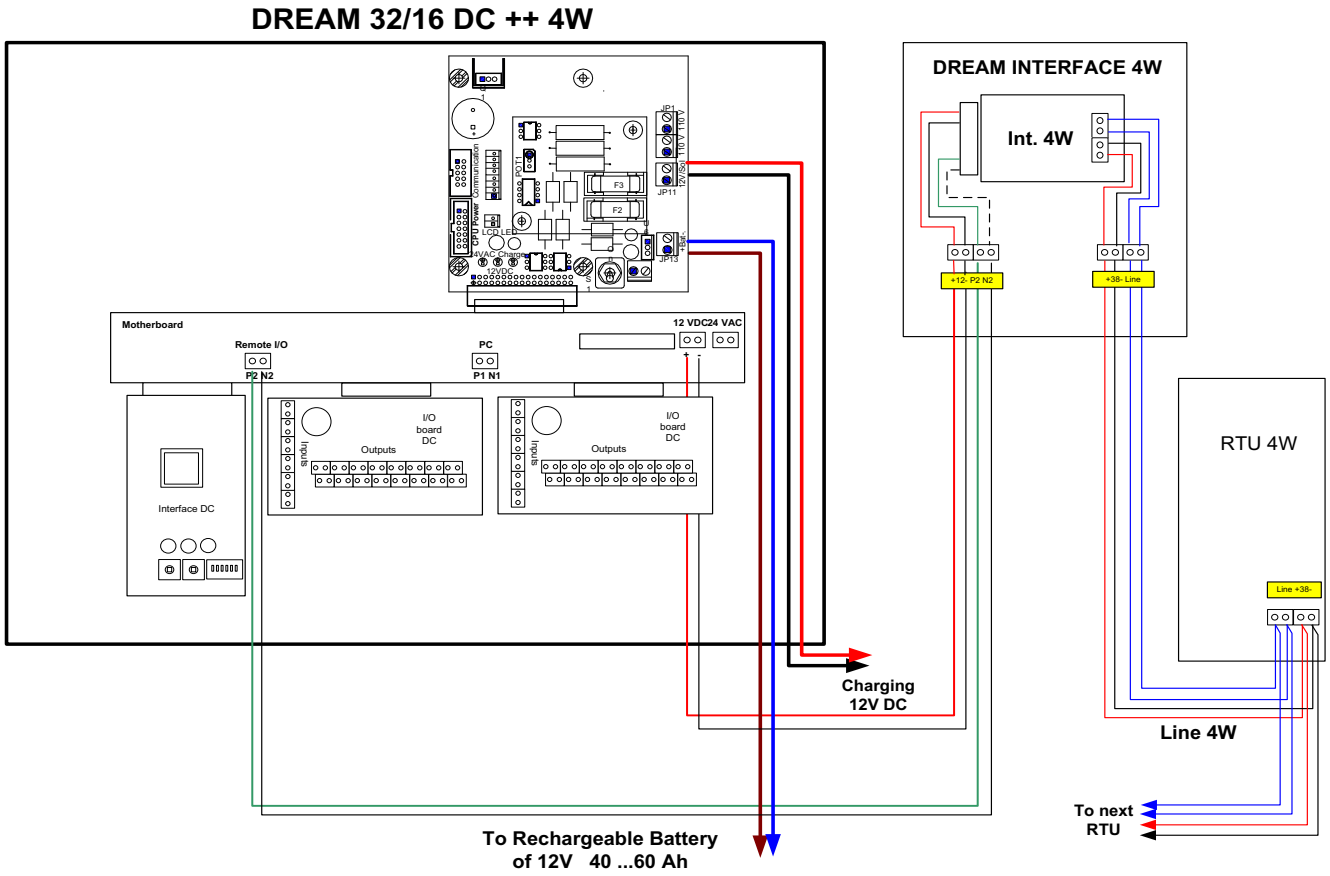
Analog inputs can be read either through the 2W RTU system (both by the modular and the compact RTU units as explained in the "DREAM 2, 2W RTU SYSTEM 2012"), or directly by using special interfaces for analog inputs. There are two types of analog inputs interfaces, the compact one can handle 2 or 4 inputs and the modular one can read up to 64 analog inputs, divided into batches of 8.

INTERFACE FOR pH/EC CONTROLLED INJECTION

When the fertilizer injection system is required to control the injection by the levels of the pH and EC, a special interface is utilized. The pH/EC interface is capable of handling 6 injectors, it is equipped with a display and key board which enable doing some calibrations and parameters setting without the intervention of the DREAM. During the injection process, it receives from the DREAM all the details and the requirements of the particular process and it executes the injection accordingly. All along the process, the DREAM is reported online about the status and the results. Detailed information about the pH/EC control can be found in the manual "FERTMASTER pH/EC USER GUIDE 2007".

INTERFACE FOR SINGLE CABLE 4 WIRED RTUS

There exists interfaces that enable connecting to the DREAM 2, 4 wired RTUs of the type used by the SAPIR control system. This feature enables upgrading the older generation system to the new one without replacing the RTUs existing in the field. The following drawing shows the connection of the interface 4W to the DREAM system.



The various I/O interfaces are connected to the CPU by an RS485 communication channel through which they exchange information with the CPU second by second. The fact that different I/O interfaces may be connected to that communication channel gives the system it's excellent flexibility. The DREAM will accept a combination of maximum 5 interfaces.

POWERING THE DREAM SYSTEM

The way of powering the DREAM 2 system and the remote I/O expansion units, depends on the existence of continuous electric power supply at the installation site. When electric power supply is available, the DREAM 2 will usually be powered by electricity from the mains, otherwise it will be powered by solar energy. In both cases, a rechargeable backup battery keeps energizing the system when the charging source is out, however while DC system can be fully operational when fed from the battery, the AC systems cannot, the outputs cannot be activated.

The type of the power supply unit suitable for the particular DREAM system depends on the charging source and the type of the system. The following types of power supply units exist:

- AC/DC - powered from the mains and used for DREAMS having no local AC outputs.
- AC/AC,DC -powered from the mains and used for DREAMS having local AC outputs.
- DC/DC - powered by solar energy and used for DREAMS having no local AC outputs.

DREAM 2, 16/8 AC and DREAM 2, 32/16 AC which activate local outputs of 24V AC must be powered from the mains.

The following table shows the various power supply units and the type of rechargeable battery required for each type of DREAM 2 system:

TYPE OF DREAM	ENERGY AVAILABLE FROM THE MAINS			ENERGY SUPPLIED BY SOLAR PANEL		
	Power Supply	**Battery**	**Transformer**	**Power Supply**	**Battery**	**Solar panel**
DR16/8 DC DR32/16DC DR16/8 DC++ RF	AC/DC	7 -40Ah *	40VA	DC/DC	7 -40Ah **	10-20W ***
DR16/8 AC DR32/16AC DR16/8 AC++ RF	AC/AC,DC	7 Ah	75VA	---	---	---
DR++ 2W DR++ 4W	AC/DC	7-40 Ah *	40VA	DC/DC	40 Ah	20W
DR16/8 DC++ 2W DR16/8 DC++ 4W	AC/DC	7-40 Ah *	40VA	DC/DC	40Ah	20W
DR16/8 AC++ 2W DR16/8 AC++ 4W	AC/AC,DC	7 Ah	75VA	---	---	---
DR++ RF	AC/DC	7 Ah	40VA	DC/DC	7 -40Ah **	10-20W ***
DR16/8 DC++RF++2W DR16/8 DC++RF++4W	AC/DC	7-40 Ah *	40VA	DC/DC	40 Ah	20W
DR16/8 AC++RF++2W DR16/8 AC++RF++4W	AC/AC,DC	7-40 Ah	75VA	---	---	---

* The size of the battery selected depends on the maximum length of power outage anticipated. A fully charged 7Ah battery is capable of supplying the system consumption for about 30 hours while a 40 Ah battery will be sufficient for about 200 hours without charging.

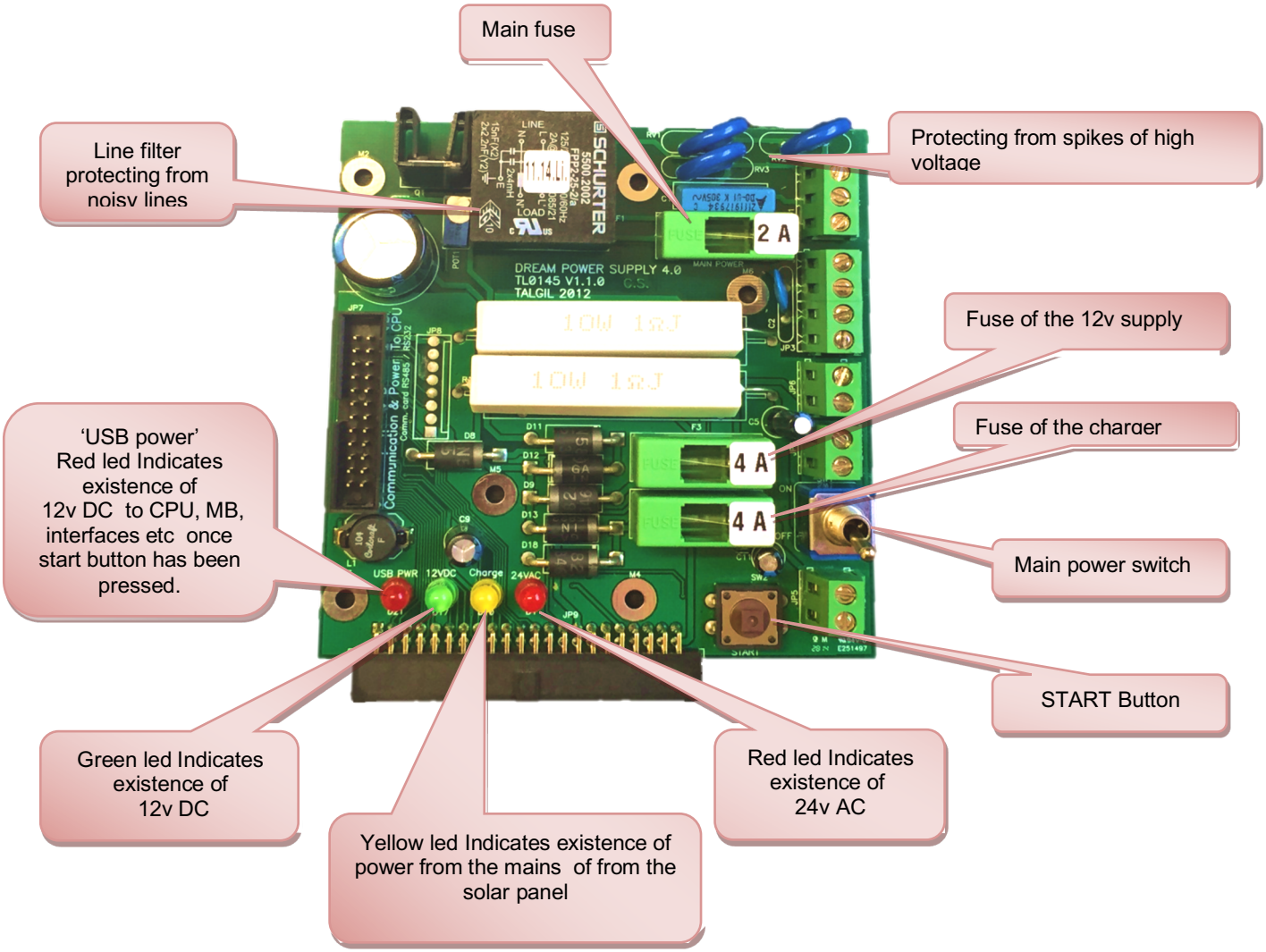
** The size of the rechargeable battery depends on the light conditions at the project site. A fully charged 7Ah battery is capable of supplying the system consumption for about 30 hours while a 40 Ah battery will be sufficient for about 200 hours without charging.

*** The solar panel of 10W in each hour of good sun light conditions will compensate for 2 hours without sunlight, therefore in those cases where during the irrigation season there are less than 8 hours of sunlight the 20W solar panel should be preferred.

IMPORTANT NOTICE:

A rechargeable battery should never let to be completely discharged. The battery may suffer a no recoverable damage and when being recharged, its consumption may be too high and blow the fuse of the charger. Therefore, when long outages of the charging source are expected, the battery should be disconnected, and before reconnection the battery must be checked and if necessary, recharged externally.

Let's have a closer look at the power supply board:

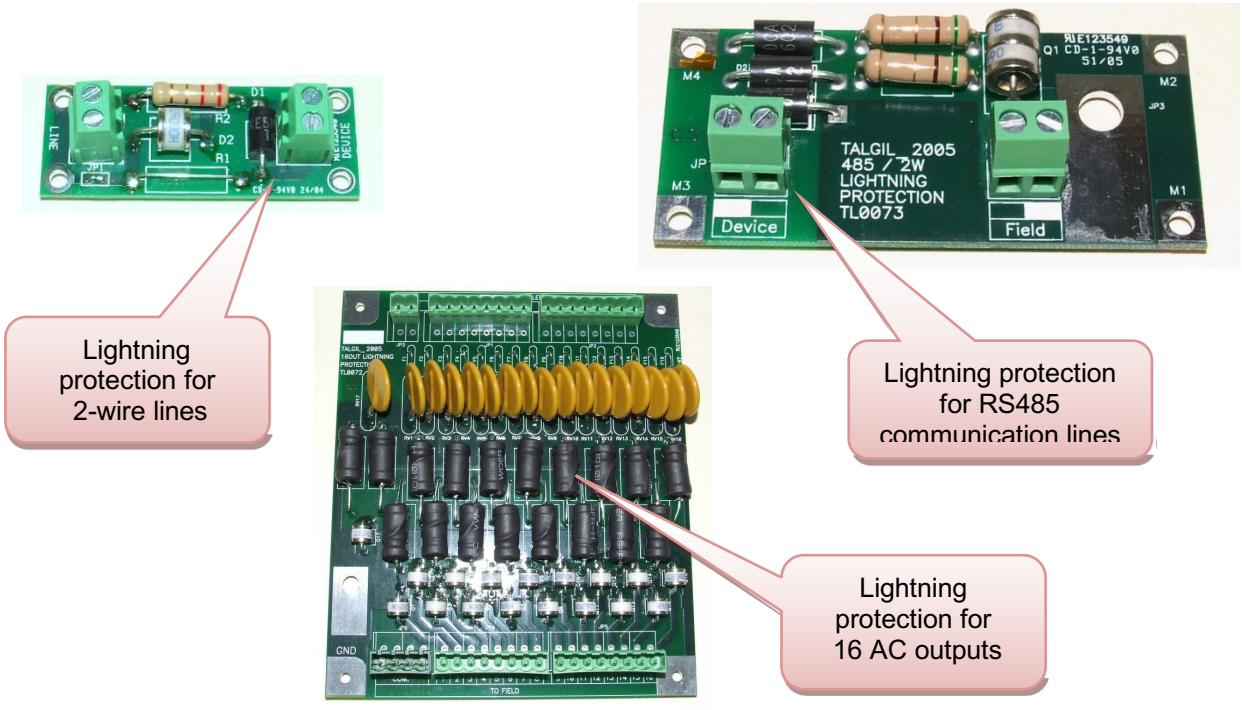


The power supply unit serves also as a trickle charger that keeps the battery at a constant level. It contains a charge limiter protecting the battery from being overcharged. It is equipped with tools for detecting low battery, loss of AC power and short circuit at the AC outputs.

LIGHTNING PROTECTION

A lightning will usually penetrate the system through the long cables connected to it, therefore all the long cables must be protected against lightning.

In the DREAM 2 ++2W the 2 wired line can be kilometers long therefore must be well protected. The communication line between the PC and DREAM when it is done by cable, can also be kilometers long and requires protection. In DREAM 2 AC all the wires from the AC I/O boards to
all the solenoids can be hundreds of meters long and therefore should be protected as well. The protection is achieved by adding protection units between the line coming from the field and the device to be protected. The protection circuits contain components that react very fast when hit by a lightning turning into short-circuit that leads the lightning energy into the ground. For this to happen, each lightning protection unit must have a very good connection to the ground. In the 2W systems each RTU has a built in lightning protection therefore it is very important not to forget the connection to the ground of each RTU. The connection to the ground is done by a thick wire connected to a metal rod inserted deeply into the ground.
The following pictures show three types of lightning protection units- one that is used for the 2W single cable system, the second that is used for protecting the RS485 communication line, and the last one is for protecting the wiring that goes from the I/O AC board to the 16 AC solenoids connected to it.



Notice that all the three lightning protection boards have one side marked “Field” or “Line”, this is the side where the cable coming from the field should be connected. The other side, which is marked “Device” is the side where the protected device will be connected.

Notice also that the RS485 protection board has at both sides of its terminals one terminal, which is marked by a white spot and the other which is not. This is done in order to be able not to confuse between the “P” (positive) and “N” (negative) wires of the RS485, if the “P” was connected to the white spot terminal on one side the continuation of the “P” at the other side should also be connected to the white spot.

Although lightning protection units can do a very good job protecting the system from being severely damaged by lightning hit, it must be understood that we cannot expect a 100 percent protection in any case. There is no protection against a direct hit, the energy of the lightning is too high to be absorbed by any protection system.

THE ENCLOSURES USED FOR THE DREAM SYSTEM

The DREAM controllers are supplied in a metal cabinet

The metal cabinet is of a size to accommodate additional interfaces, expansion boards, lightening protection boards and the Spider unit.

INSTALLATION STEPS

Setting up a DREAM 2 control system consists of the following steps:

- Mounting the controller and its peripherals.
- Defining the system's configuration.
- Connecting the input/ output devices to the controller and the RTUs.
- Testing operation of all the inputs/ outputs

Any connection or disconnection of components to the system must be done only while the power switch is turned OFF, otherwise unpredictable damage might be caused.

MOUNTING THE CONTROLLER

The best location for mounting the DREAM 2 will be on a wall, under a roof protected from direct sunlight and rain. Therefore, people will usually place the DREAM 2 in their office, or in the pump house or just in a toolshed. Usually at those places, there will be electric power available and therefore there will be no question about how to energize the system. However, the DREAM 2 can also be installed outdoors attached to a metal pole by "U" clamps and powered by solar panel.

If the DREAM 2 is DC type which means that it activates DC latching solenoids, all the solenoids will be installed close to the DREAM and between the valves and the solenoids the connection will be by command tubes. The same is true about connection of solenoids to remote I/O DC expansion units and all kinds of RTUs, all of them activate DC latching solenoids which cannot be installed away from the commanding unit.

If the DREAM 2 contains local I/O AC outputs, obviously all the cables arriving from the solenoids will have to reach the local I/O terminal boards of the DREAM 2. The same is true about connection of solenoids to remote I/O AC expansion units.

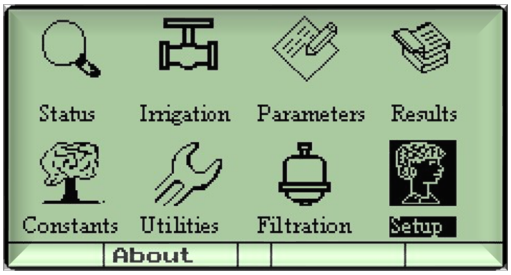
Now, the question that needs to be answered is: in which order to connect the wires of the various outputs and inputs to the terminal boards? The answer is that the order of connection is not dictated by the system, it can be decided by the installer. Inside the DREAM 2 there is a **connections table** that defines where exactly each of the declared devices is connected. So a convenient way of working will start with defining the configuration of the system in which all the devices are introduced, then defining the type of hardware constructing the system and then defining the connections table. The printout of the connections table can then be used when executing the connections in the field.

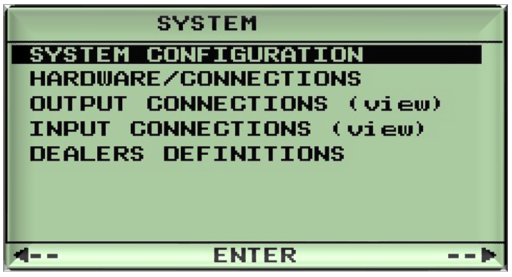
The following chapter describes the configuration process that includes the steps described above.

DEFINING THE CONFIGURATION

The configuration definition can be done in two ways: either directly from the DREAM'S control panel or by using the DREAM simulation software that simulates the DREAM controller on the PC. If the configuration was done by the simulation software, the configuration file should later be loaded into the DREAM. Explanation about the simulation software and the loader see below at the chapter about ADDITIONAL SOFTWARE TOOLS.

For starting the configuration process, select **" Setup "** in the main menu, then in the submenu select **" SYSTEM CONFIGURATION "**.
The selection is done by the **ENTER** key.





Entering into the SYSTEM CONFIGURATION subject without inserting a password enables only to watch the existing configuration. In order to get permission for defining a new configuration, a password is required. **" The password is 139 ",** it is not a secret password, it is only meant to make the user think again before erasing the previous definition and all the accumulated information.

IMPORTANT: Beware that starting a configuration process is involved with deletion of all previously defined and accumulated data, including irrigation programs.

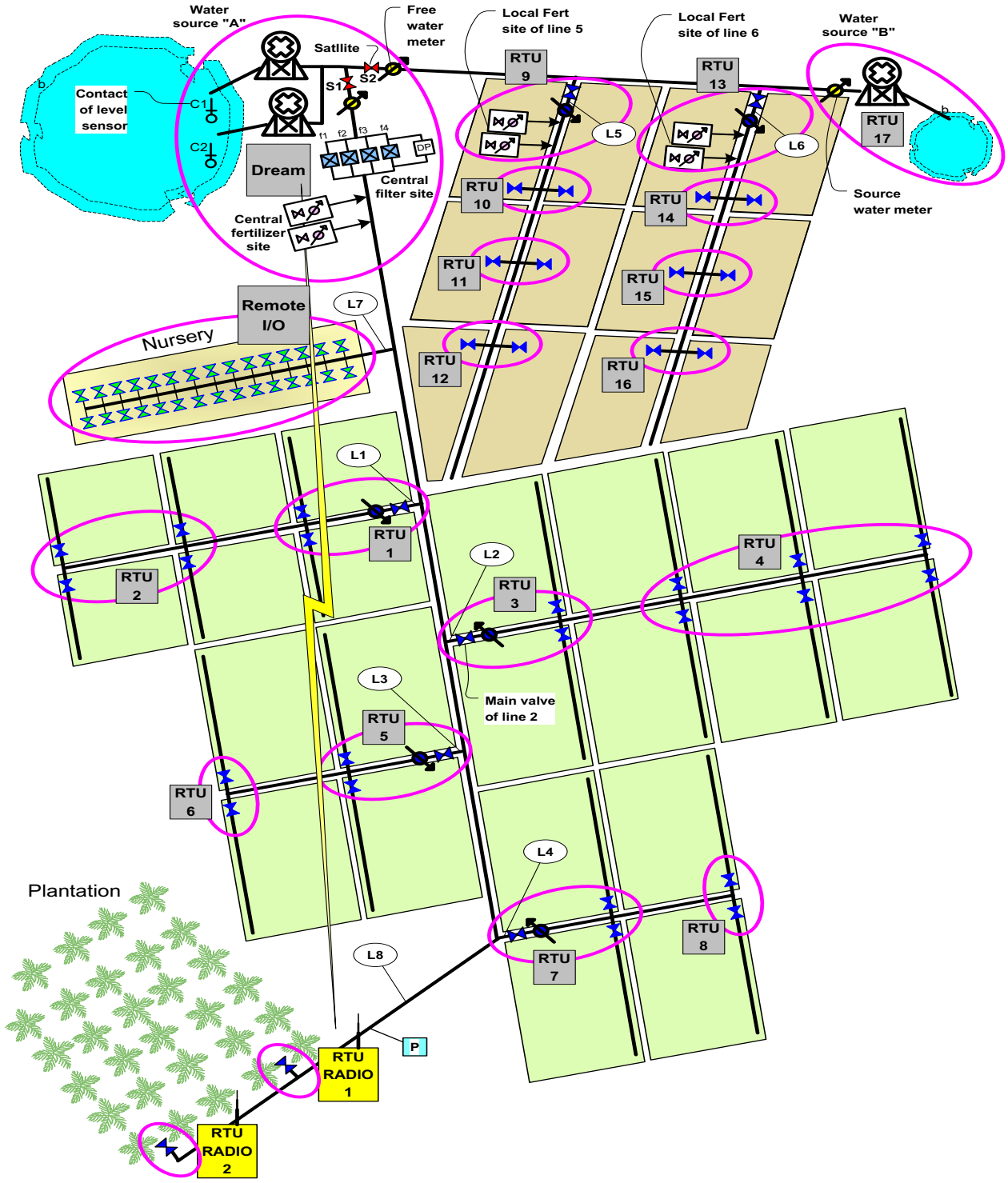
The configuration process consists of three steps:

- Network definition – includes the definition of the hydraulic network structure the devices to be controlled and the relation between them.
- Hardware definition – defines the kind of hardware used by the system for controlling the devices defined during the network definition.
- Connections definition – defines the connections table that contains the lists of all the physical connection points of the devices defined. When the system contains only local I/O and does not make use of any RTUs, it is very convenient to use the option of AUTOMATIC ALLOCATION that makes the connections allocation automatically, allocating the inputs/ outputs in a sequential manner.

At the end of the last step the physical connection of all the devices is well known, therefore the wiring process may be started.

The following page contains an example network, which will be used for demonstrating the configuration process.

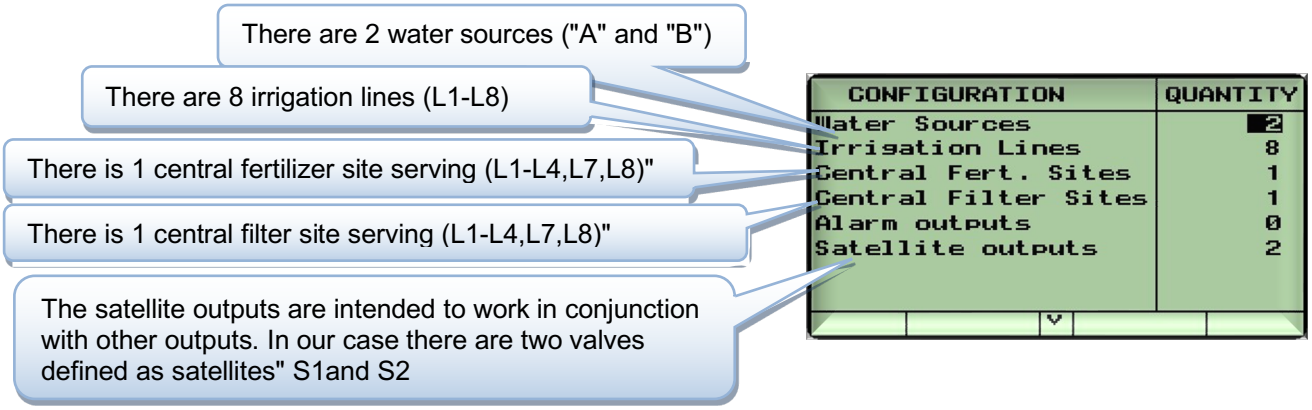
The example demonstrates a system with two water sources "A" and "B" and 8 irrigation lines marked L1 – L8. Lines L1 to L6 are irrigating field crops, line L7 is a nursery, and L8 irrigates a palm plantation.
The DREAM control unit is located at the pump house at source "A" where electricity is available. The accessories that are in close proximity with the DREAM, are wired directly to the local I/O terminal boards at the DREAM itself.
The accessories of lines L1 to L6 and the second water source are connected by use of 17 single cable RTUs.
The connection of the plantation L8 is done by 2 radio RTUs, and the nursery L7 which contains a large number of valves close to each other, will be connected by a remote I/O expansion unit.



THE NETWORK DEFINITION

The network definition process consists of a series of screens through which the contents and the structure of the network is defined. The screens are arranged in a vertical order. Use the **PAGE DOWN** (⮟) and **PAGE UP** (⮝) keys to move between the screens.

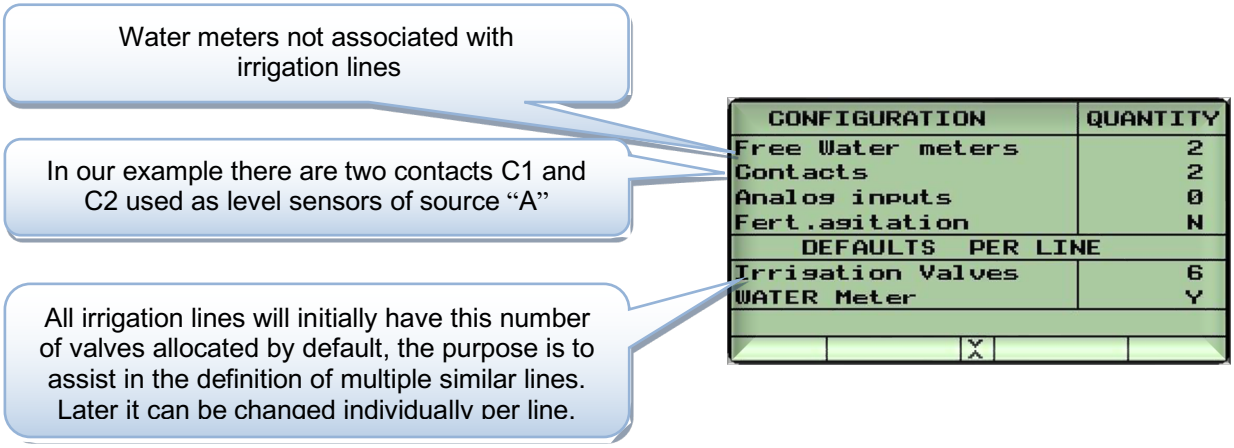
We start by declaring the quantities of the main items comprising the hydraulic network:



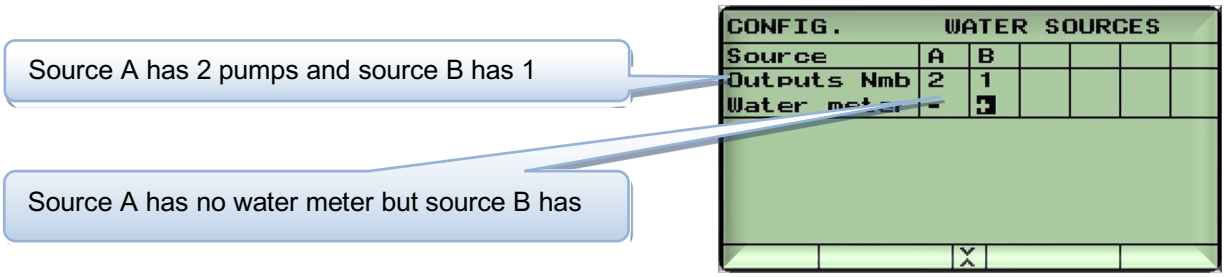
The satellite outputs are very useful tools, they can be utilized in 3 ways:

1. A satellite can be attached to any number of outputs in order to have it active as long as any of the other outputs is active.
2. A satellite can be activated by conditions when they are true.
3. Conditions can be defined on the statuses of satellites, so if we combine this feature with feature number 1 we can actually get conditions on the statuses of any outputs that the satellite is attached to.

Detailed explanation about how can the satellites be utilized, is supplied in the user guide.



When the system contains water sources each water source will have a definition of the number of outputs (usually water pumps) belonging to the water source and whether or not a water meter is included in the water source.



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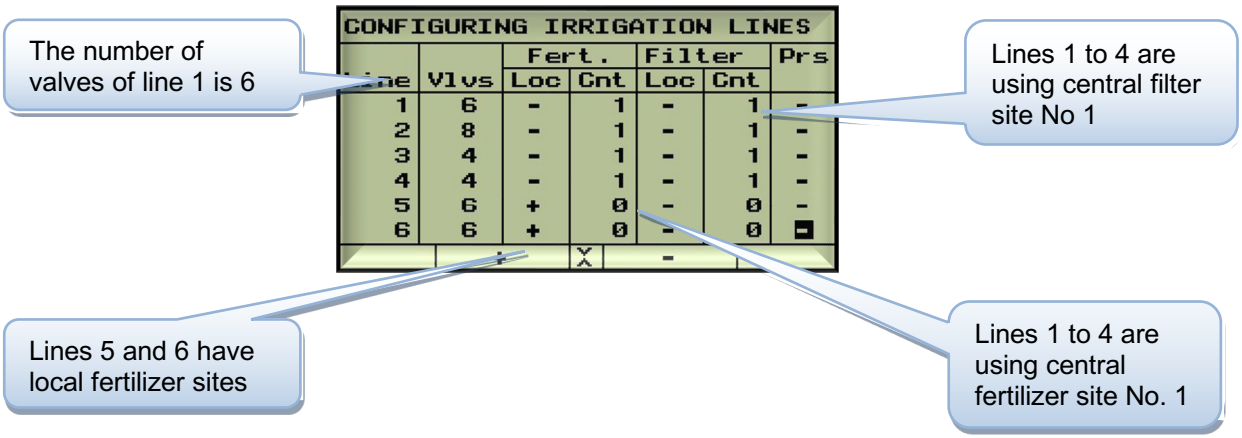
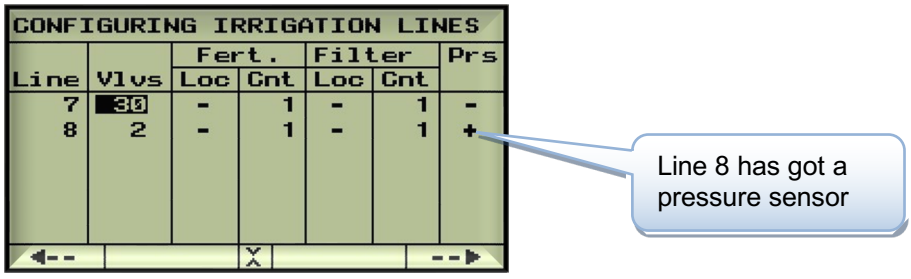
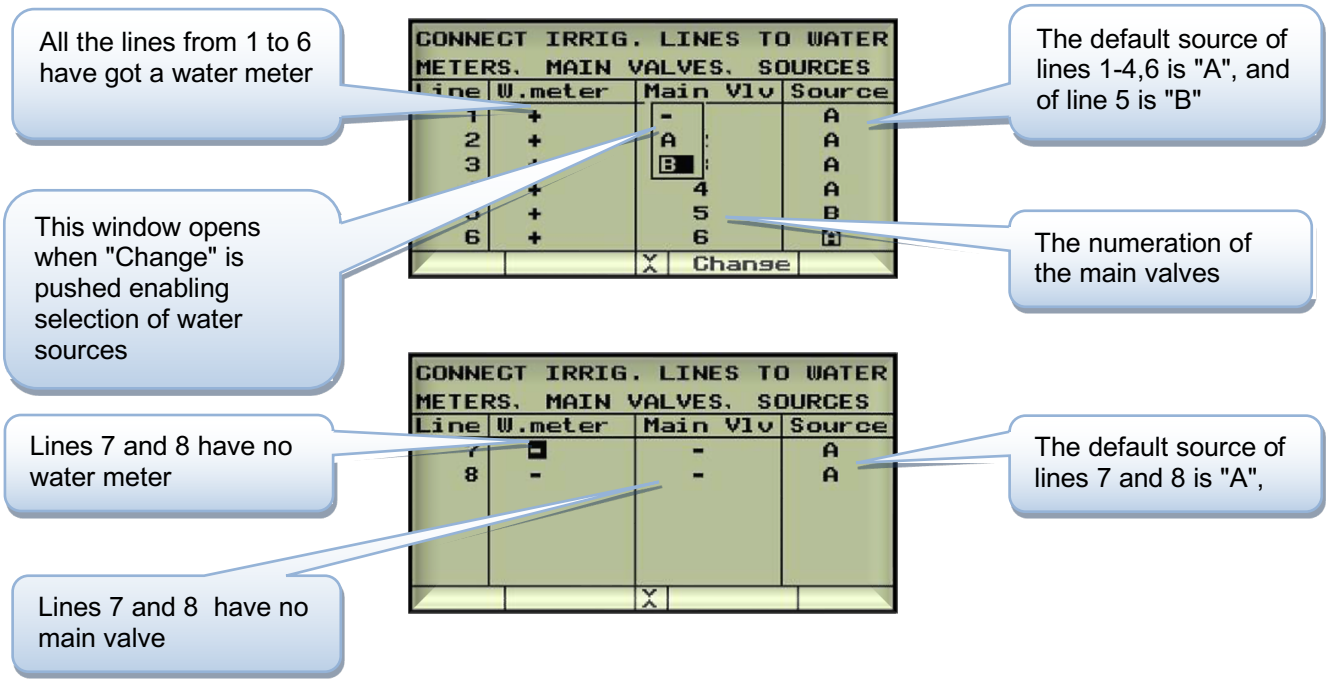
The next step will be the Definition of the irrigation lines contents by supplying the following information:

- how many valves belong to each line
- existence of local fertilization on the line
- when the line is connected to a central fertilizer site, to which ?
- existence of local filter on the line
- when the line is connected to a central filter site, to which ?
- existence of pressure sensor on the line. If yes, it should be with dry contact and normally open type.

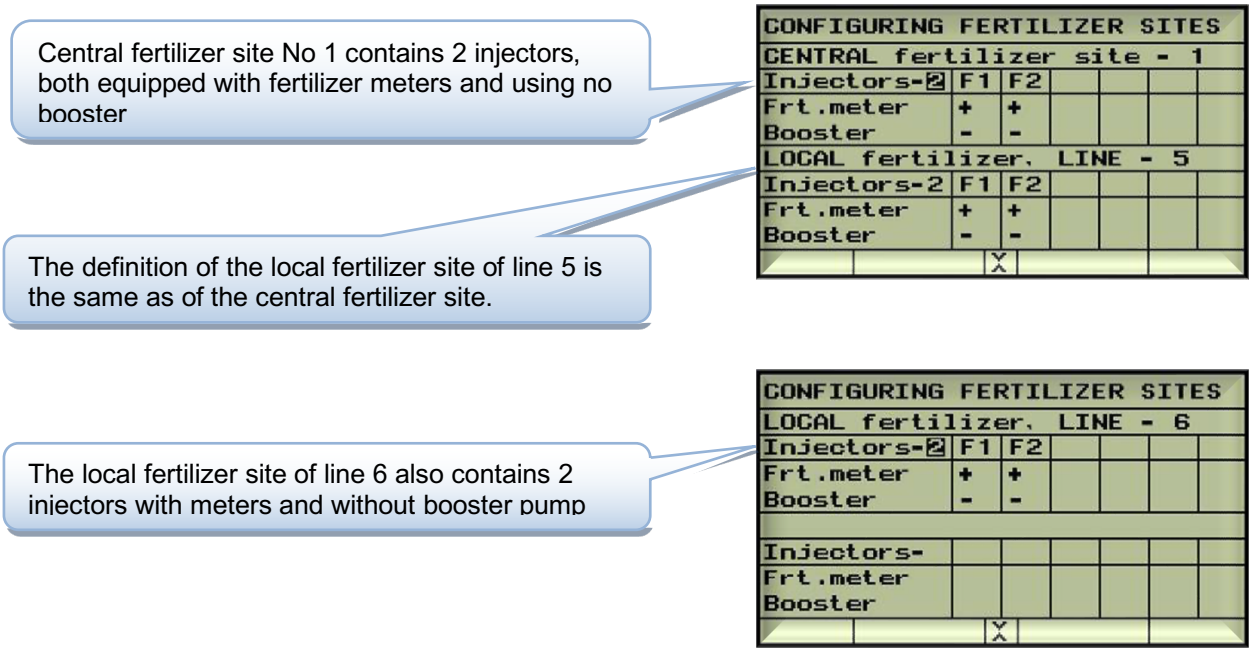




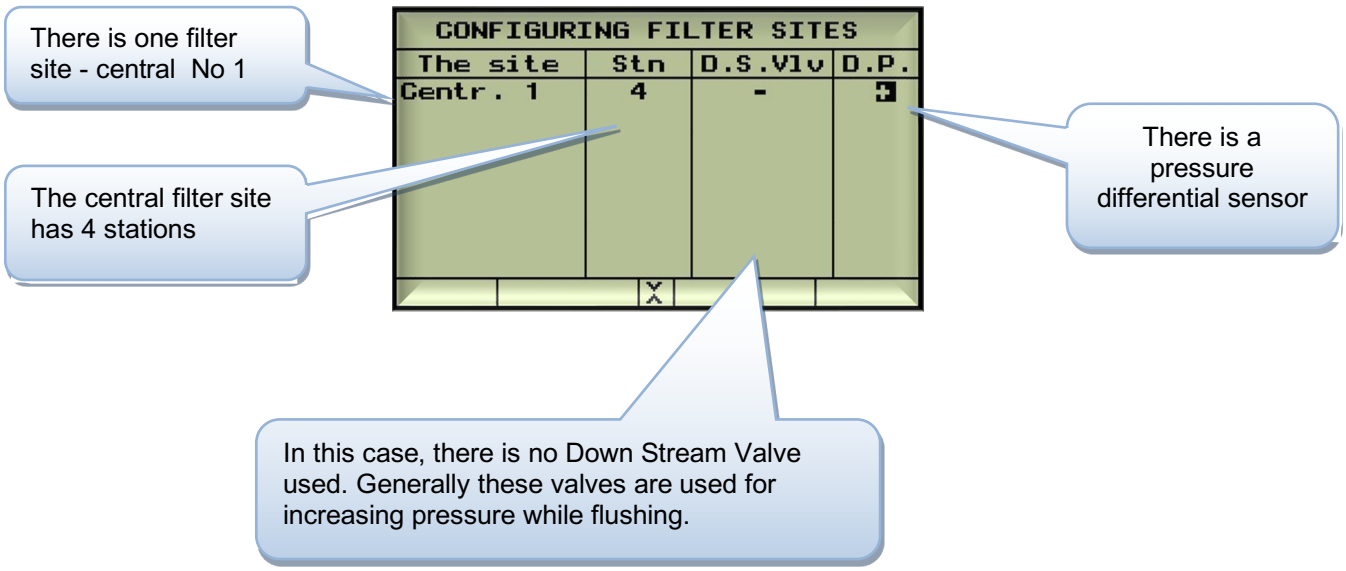
The next step is defining which water meters, which main valves and which water sources are used by each irrigation line. The selected water source will be used as default during definition of irrigation programs. Notice that when each irrigation line has it's own main valve you can use the automatic numeration button, otherwise you will have to do the numeration yourself.



Next step is the definition of the fertilizer sites. For each site, set the number of injectors and for each injector specify whether it uses a fertilizer meter and/or a booster pump.

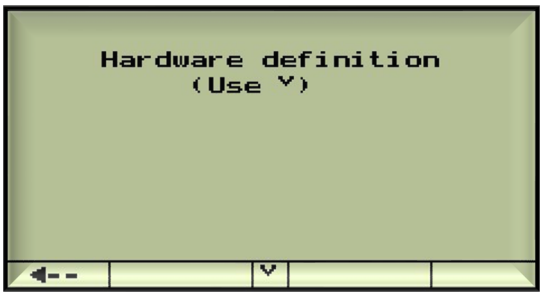


The next step will be the definition of the filters sites



At this stage we are finished with the network definition, pushing **PAGE DOWN** (⮟), brings us back to the top screen of NETWORK DEFINITION from which we can pass through the NETWORK DEFINITION once again or continue to the HARDWARE DEFINITION by using the rightmost red function key.

THE HARDWARE DEFINITION



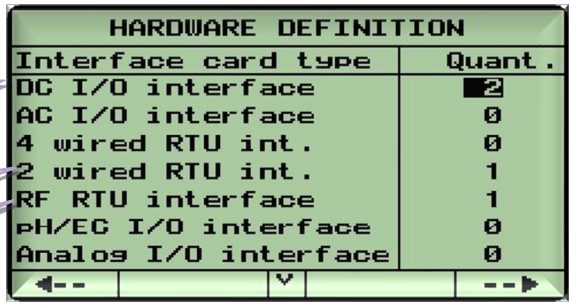
The hardware definition starts with specifying the types and the quantities of I/O interfaces utilized by the specific system.

The following list contains the various options of I/O interfaces. You should specify which type of interfaces and how many of each type are being used in your system.

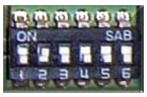
In our example there are 2 DC I/O interfaces, one inside the DREAM 2 and the other inside the remote I/O at the nursery

There is 1 two wired RTU interface serving the communication with RTUs 1 to

There is 1 Radio RTU interface serving the communication with Radio RTUs 1



In the following table we specify the addresses given to each interface by setting the dipswitches on the various interface boards.



The DC or AC I/O interfaces can drive 1 or 2 I/O boards, therefore when it drives a single board there will be 16 outputs and 8 inputs (16:8) available and when it drives 2 I/O boards there will be 32 outputs and 16 inputs (32/16) available.

For the radio RTU interface, apart from the address we must select the scanning rate by which the DREAM will be scanning the radio RTUs, the options are: 1.25 sec; 2.5 sec; 5.0 sec; 10.0 sec. A complete description of the radio RTU system setup can be found at "THE RF RTU SYSTEM GUIDE 2012".

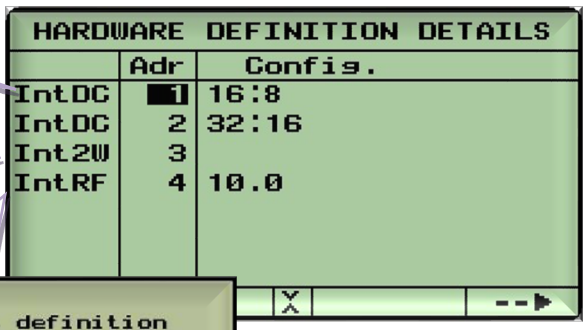
Interface DC No1 (on DREAM) has 1 I/O board 16/8 (16 outputs, 8 inputs)

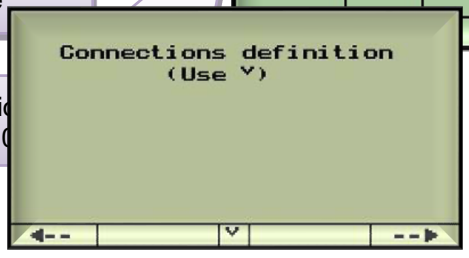
Interface DC No2 (on REMOTE I/O unit) has 2 I/O boards of 16/8 (32 outputs, 16 inputs)

Interface No3 is the 2 wired RTU interface

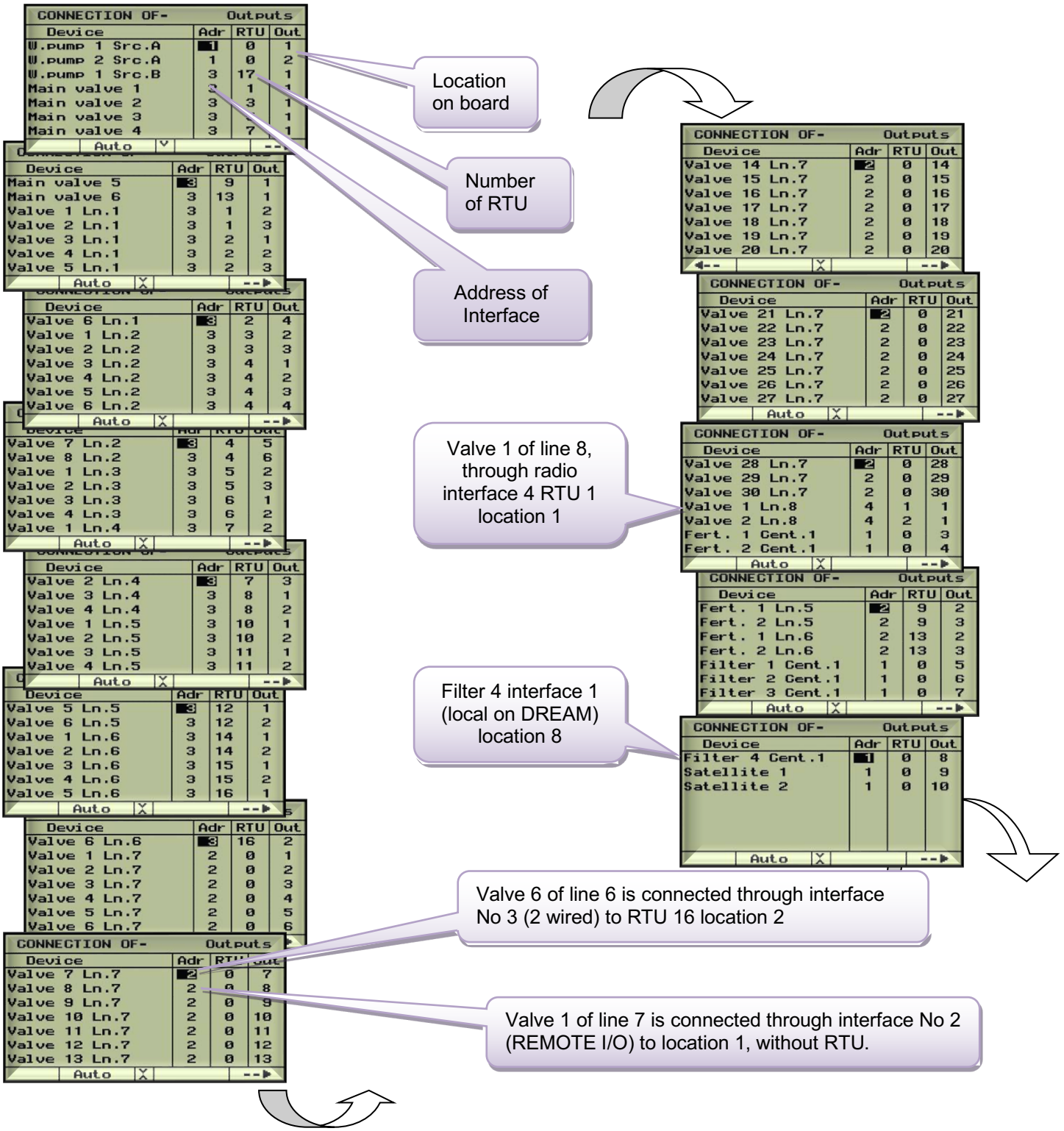
CONNECTIONS DEFINITION

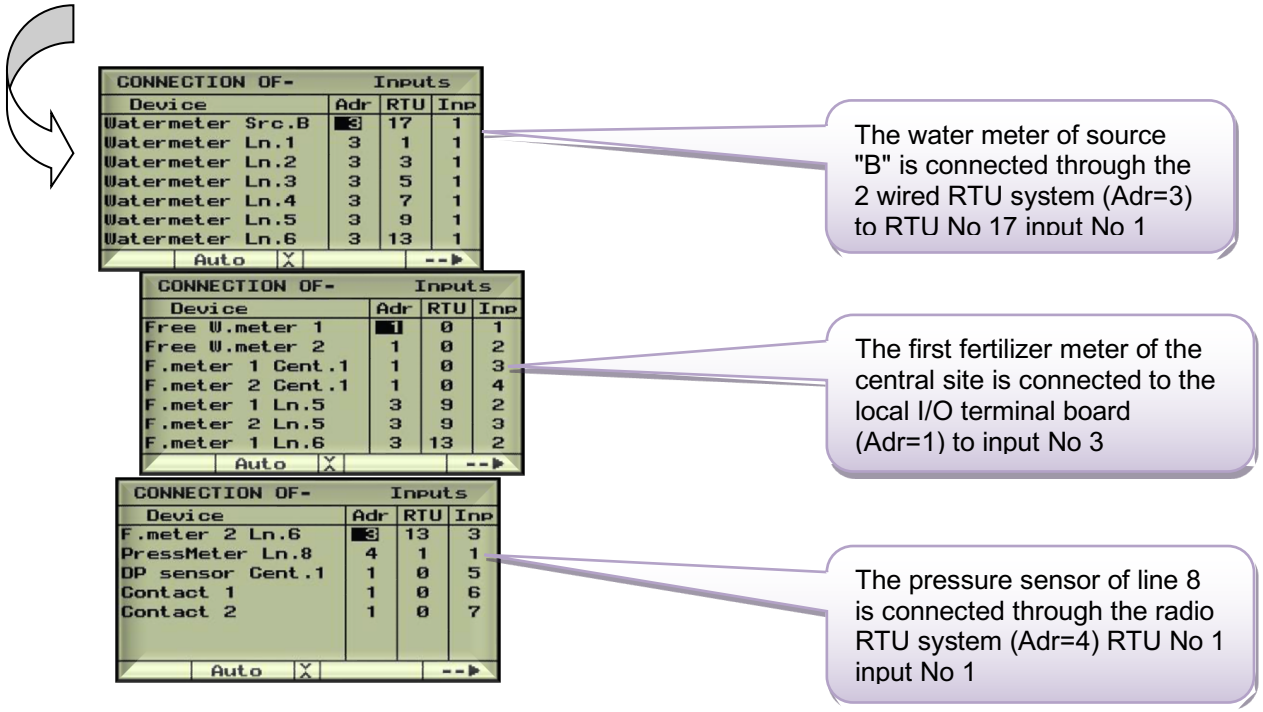
Interface No4 is the radi
scanning rate is set to 1





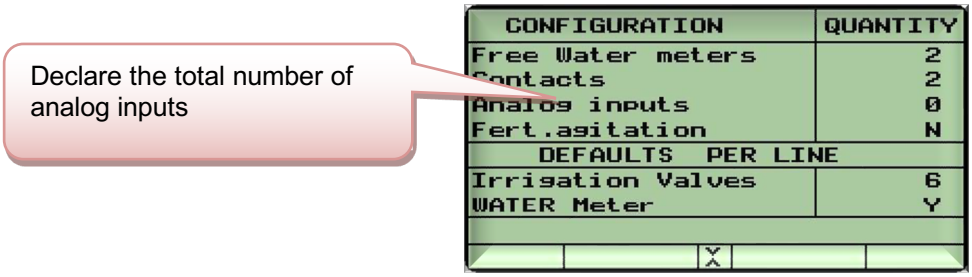
During the following step we define where each of the outputs and each of the inputs are going to be physically connected, first the outputs and then the inputs. For each item we have to supply the address of the interface used for the connection, the number of the RTU if the connection is through an RTU or “RTU = 0” otherwise, and the specific location on the board (RTU board or I/O board)



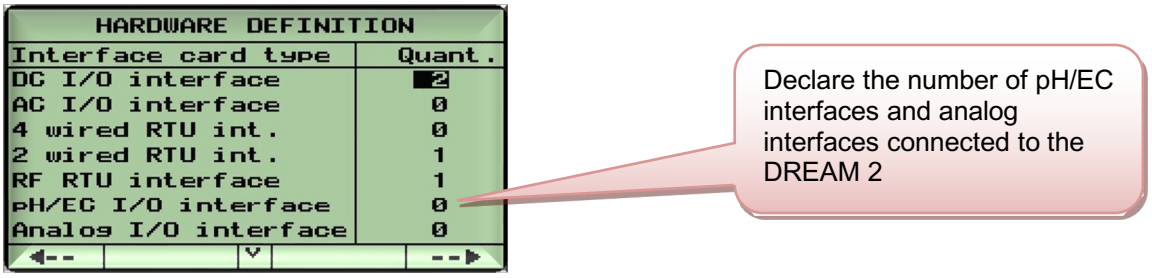


ANALOG INPUTS AND pH/EC DEFINITION

Analog inputs in general and pH/EC inputs in particular need a special attention. First, the total number of analog inputs must be declared at the NETWORK DEFINITION step as shown below:



During the HARDWARE DEFINITION, the type of hardware used for reading the analog inputs must be defined. When the analog inputs are connected through the 2W RTU or the RF RTU system, no need to specify any additional hardware, but if a special analog interface or pH/EC interface are utilized, they must be declared as shown below.



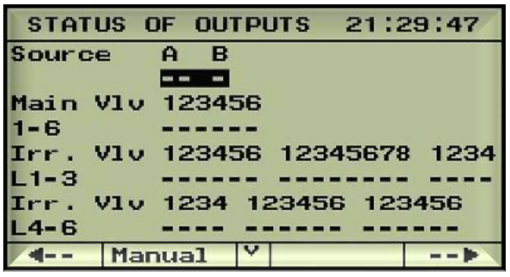
DURING the CONNECTIONS DEFINITION, for each analog input the address of the interface through which it is connected must be specified. For the pH/EC inputs, the rest of the data will be filled out automatically by the system, but for the other analog inputs it must be inserted manually to which input terminal in which RTU they were connected. Here we have to point out that there are two kinds of interfaces for analog inputs: the compact ones for up to 4 inputs and the modular ones that come in batches of 8 up to 64. Notice that in both cases we say that the analog inputs are connected through RTUs, in case of the compact one, the RTU address must be set to 1, and in case of the modular one, the RTU address will be the address of the particular analog board (1 up to 8) to which the specific analog input was connected.

TESTING WIRES BEFORE CONNECTING THE INPUTS/ OUTPUTS

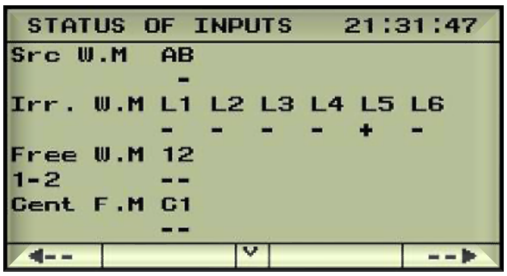
Prior to the connection of the cables, each pair of wires must be tested for continuity, to make sure they are whole all the way along. For this test, we twist the wires together at one edge (with the isolation removed) and measure the resistance at the other edge; it should not be greater than 150 Ohm. A second test is needed to make sure that there is no short circuit or leakage of the isolation between the wires or to the ground. For this test we leave both edges of the wires disconnected and measure the resistance between them, and between each of them to the ground. The result must be greater than 1 Mega Ohm.

TESTING THE OPERATION OF INPUTS AND OUTPUTS

The installation process is not complete before all the outputs and all the inputs are tested and found functioning properly.



For testing the outputs, we can use the "MANUAL OPERATION" mode that can be activated from the screen STATUS OF OUTPUTS. In the main menu select STATUS and then OUTPUT. Push the red function key (F2) underneath the word "Manual", the cursor changes its form into a blinking underline "–", now by using the horizontal arrows ⇨⇦, the cursor can be moved to the right and to the left, enabling selection of outputs from the list. For activating/ deactivating the selected output we use the same function key (F2) again which is now marked "ON/OFF". The activated outputs will be marked by the symbol "^". To exit the manual operation mode the ENTER key is used.



The status of the inputs is displayed in the screen STATUS / INPUTS.
Each input that senses a closed contact appears with a "+" sign.

WHAT COMES NEXT?

Before starting to use the DREAM 2 system for controlling the irrigation, there are still some more things to do. There is the DEALERS DEFINITION that should be visited in order to do some "fine tuning" of the system to make it best suit the actual application. Another important thing is the setting of the CONSTANT parameters without which the configuration process is not complete. Both of these two subjects are covered in details in the "DREAM USER GUIDE 2015".

COMMUNICATION OPTIONS WITH THE DREAM 2

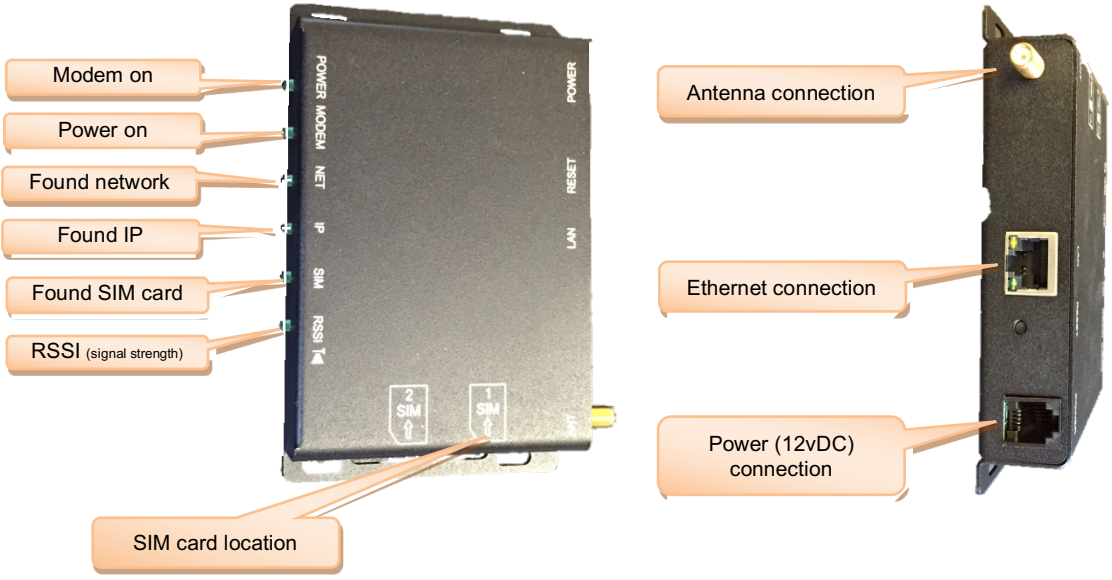
The DREAM 2 system allows communication to PC's, Tablets and Smartphones via the internet using two versions of software for this communication. It allows the operator to have the ability to operate the system on any web browsing device such as a smartphone or having a full 'Windows' view on the PC Console. Either option allows multiple operators on multiple devices to have access to the system. I addition if the operator has more than one Dream 2, Vision 2 or Oasis controller they can all be accessed on these devices via a drop down list. Email alarms are also available through the software

The Mother Board installed in the Dream 2 has an Ethernet port installed allowing connection to the internet via this port to a modem/router.

GOLDTEC SUPPLIED WIRELESS ROUTER

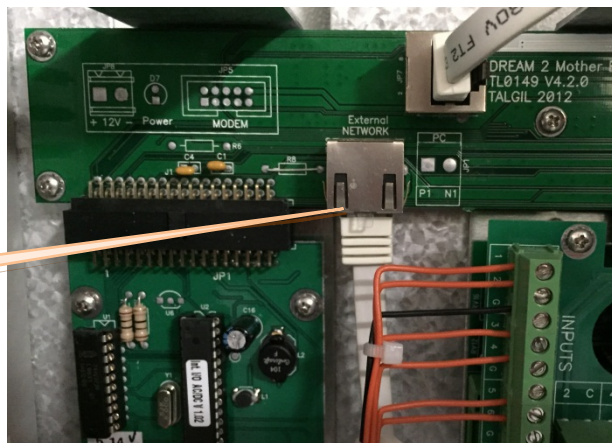
When wireless internet is available and there isn't any local internet connection a modem/ router is supplied and installed in the main Dream 2 enclosure. This router is connected to the Dream 2 via a Ethernet cable and powered via the Dream 2 power supply.
The router can be supplied with either a small magnetic 3db antenna with 3m coax cable (standard supply) or to boost the reception a 9db 6' broomstick antenna with 10m of coax can be optioned.

I SIM card is required to be installed in the router. This SIM card should be setup on an internet data plan of at least 1GB/mth



OPERATOR SUPPLIED INTERNET CONNECTION

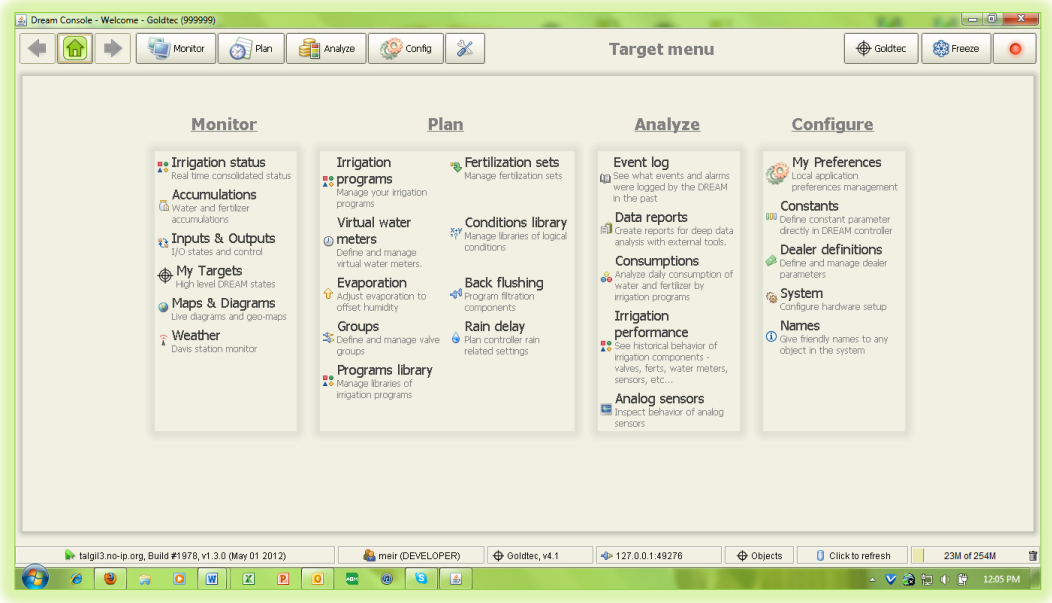
If the operator has internet available and his modem/router has a spare port and is within a reasonable distance from the Dream 2 controller then an Ethernet cable can be connected from this modem directly to the mother board on the Dream 2 supplying the system internet.
Internet data of at least 1GB / mth will be required.



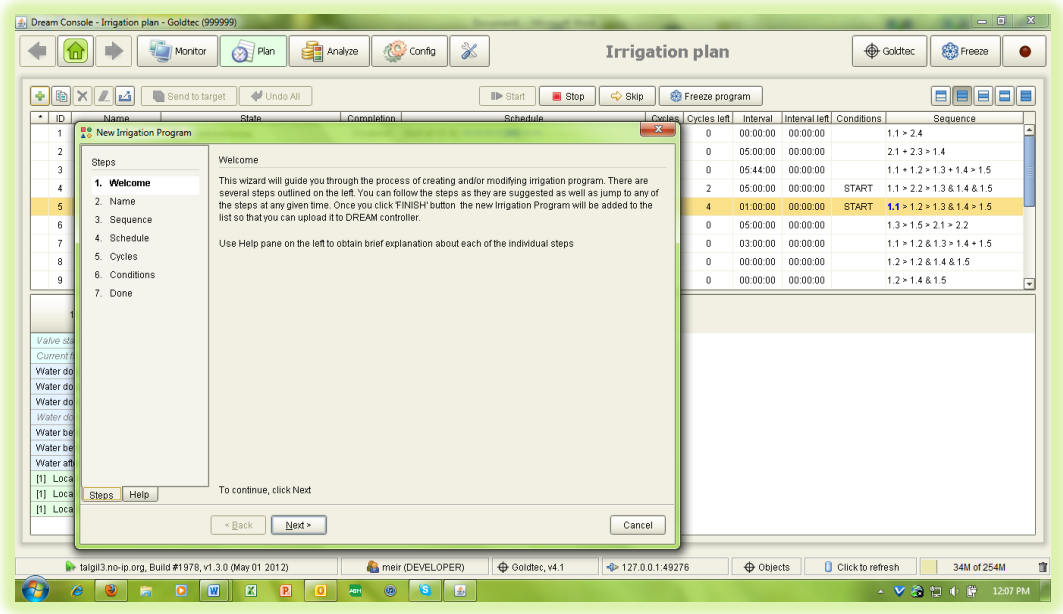
DREAM 2 SOFTWARE

DREAM-CONSOLE PC software

The DREAM 2 CONSOLE PC software is designed to enable remote programming and control of the DREAM system from any PC running WINDOWS XP or later. The large graphical and colorful display of the PC makes the programming and the monitoring of the system much more comfortable and flexible to use.

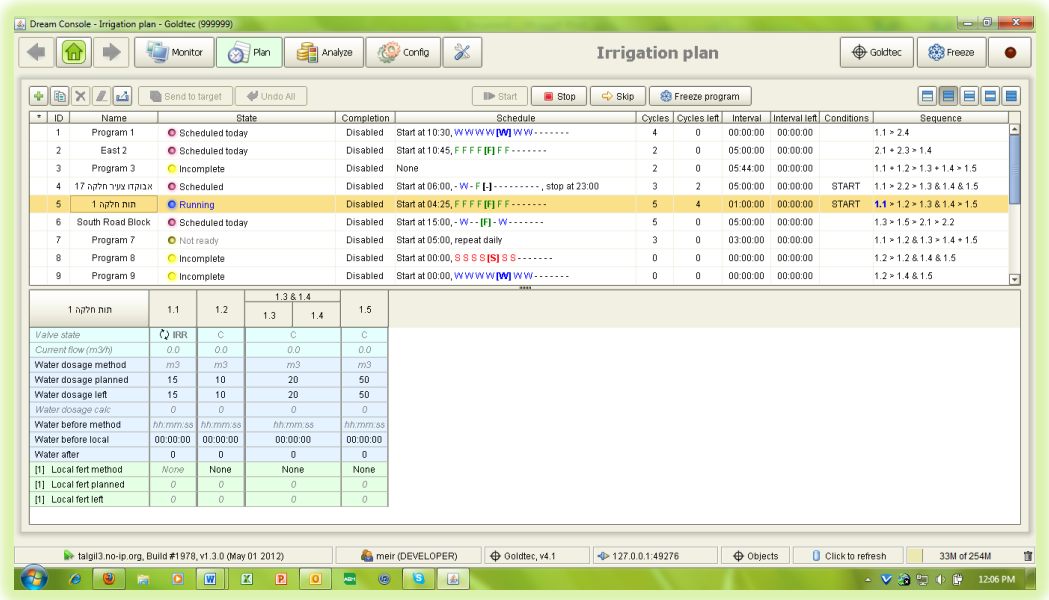


The DREAM 2 CONSOLE PC software offers simple irrigation scheduling by utilizing a “New Program Wizard” allowing the operator to follow a step by step procedure.

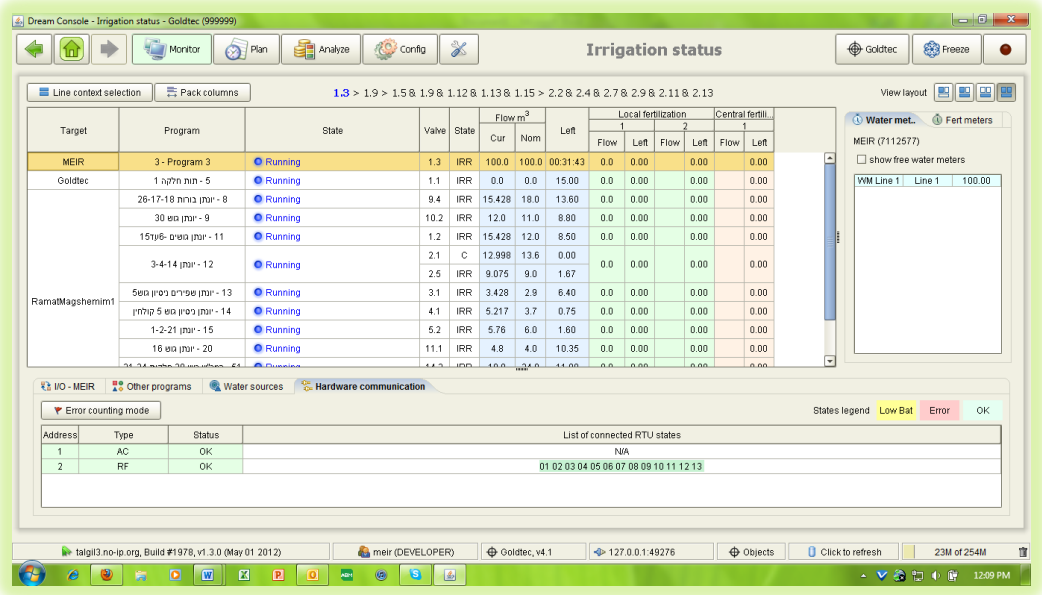


The DREAM 2 CONSOLE PC software allows the operator viewing options with the irrigation programing screen displaying an overview of all programs and components, actual program details, current status and scheduling view. Programs can be stopped, paused, started or modified in this screen

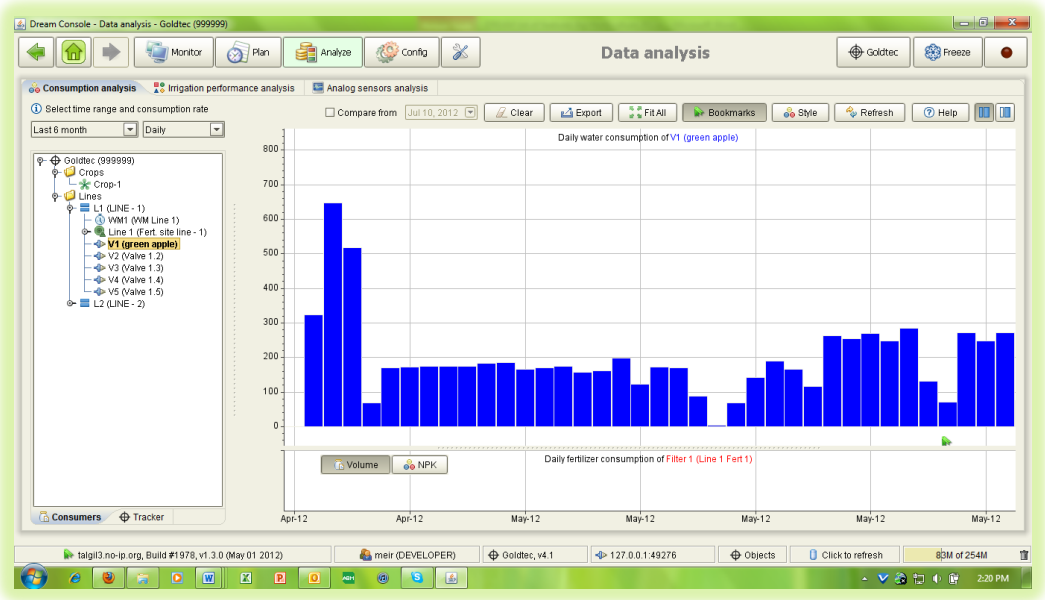
The DREAM 2 CONSOLE PC offers a 'Programs Library' where the user can prepare programs ahead of time for example different seasons of the year, then export these programs into the 'Irrigation Programs' when they are required.



The DREAM 2 CONSOLE PC software presents to the operator instant status of multiple Dream 2 system TARGETS accessible to the user. This indicates program status, currant outputs activated, currant main water meter and fertilizer meter flow rate, RTU communication or low battery state, analogue and weather station state.



The DREAM 2 CONSOLE PC software enhances the tools given to the user by adding some important features such as handling a data base in which all the historical picture is kept, giving the ability to analyze the accumulated information in various ways including graphical representation.



The data base is a mass storage of accumulated data resulting from data acquisition executed repeatedly at user defined intervals. Within the data base there is storage of the water and fertilizer consumptions per each irrigation valve, storage of all the samplings of analog sensors and storage of the reported events. The data base includes also definition of all the crops, all the plots and their sizes, all the fertilizer types with their components, and all the optional users.

The consumption can be inspected per valve, per crop, per plot and per user on an hourly, daily or annual basis. The information can be visualized in table format or in graphical format and it can be selectively summed up and printed.

The accumulated event reports can be filtered in different ways: inclusive, faults only, per specific programs, lines, valves, fertilizer sites, filter sites and events of a specific kind. The information can be sorted upward or downward by each category.

The sampled values of the analog sensors can also be inspected in table or graphical format.

The data acquisition can be limited within desired hours.

The system includes the ability of presenting the current status on a map, or several maps describing the hydraulic network. Tools are supplied for creating the desired maps presentation.

DREAM-SPOT

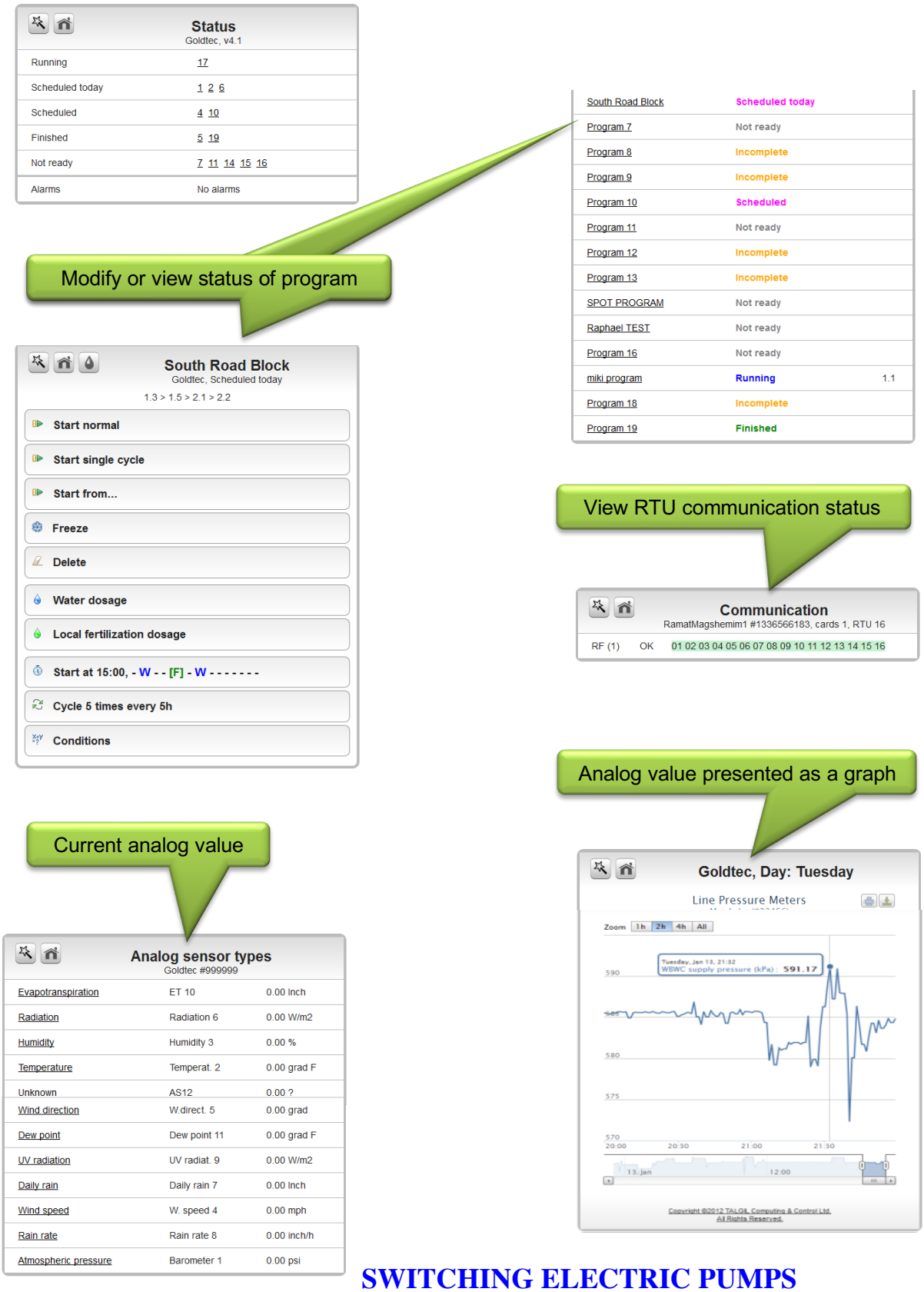
The DREAM-SPOT allows communication to your Dream 2 Controller (or Multiple Dream 2 controllers) using any Web-browsing device such as a PC, Tablet or Smartphone that is connected to the internet.

The DREAM-SPOT is included when selecting the option of Dream-Console PC software but also can be selected as a stand-alone internet communication without Dream-Console software.

The DREAM-SPOT allows the user to check the system *status*. Check the system *event log*. The *Irrigation* menu the user can check program status, stop, pause and start programs, create & delete programs, change scheduling and change dosage modes such as time or volume. In the *Flushing* menu the user can check status and start a manual flush. The *I/O* menu indicates the status of all outputs and inputs and allows the user to manually open and close outputs.

In the *Communication* menu the user can check the status of the interface and also the status of an RTU displaying communication OK, communication error and low battery state on individual RTU's.

The *Analogue sensor* menu displays the actual value of the sensor and also presents the data as a graph. The *Flow of water* and *Flow of fertilizer* displays actual flow of connected flow device.



SWITCHING ELECTRIC PUMPS

Naturally, the switching of electric pumps differs from the opening and closing of valves, which are hydraulic devices. Since the switching process is involved with turning ON/OFF high power electric sources that many times may create sparks and electric interferences, it is better to have a good galvanic isolation between the commanding unit and the pumps being switched. Therefore the switching of electric pumps in Talgil control systems is done by **PUMP- SWITCHING**

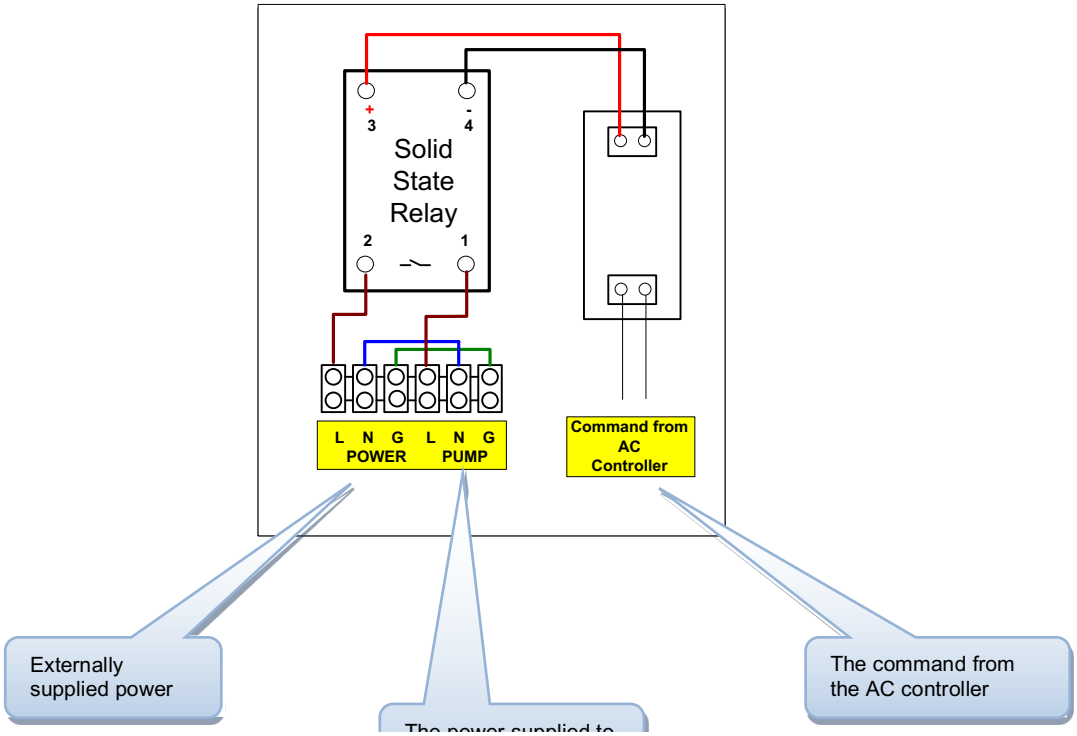
UNITS that contain a solid state relay in which the input and output are connected optically therefore they supply good galvanic isolation.
There are two types of PUMP-SWITCHING UNITS for AC and for DC command. The AC type will be used when the command is by 24vAC and the DC type will be used when the command is 12v DC latching. The DC type switching units can be commanded either by three wires with one wire (white) serving as common the second (red) for open and the third (black) for close command, or by 2 wires that work by inversion of the command polarity.

Both types of switching units act like a relay that when activated they let the power through and when deactivated they cut off the power from the load. In any case, the power must be supplied externally. The pump-switching units can be used only for AC pumps of 24 to 240 v and up to 10 A. They are meant for switching only 1 phase, therefore when the pump is a 3- phase pump or it is a too big load, then the pump-switching unit will not activate the pump directly but rather activate the contactor that will switch the pump ON and OFF.

IMPORTANT: In each package of PUMP SWITCHING UNIT a capacitor of 1 μF 400v is supplied. this capacitor should be installed in parallel with the load, otherwise in some cases the pump will not turn OFF.

AC PUMP SWITCHING UNIT

The following schematic diagram shows the wiring of the AC type pump-switching unit. The externally supplied power arrives to point 2 of the solid-state relay but it will not pass through to point 1 unless commanded to do so by the command from the controller.

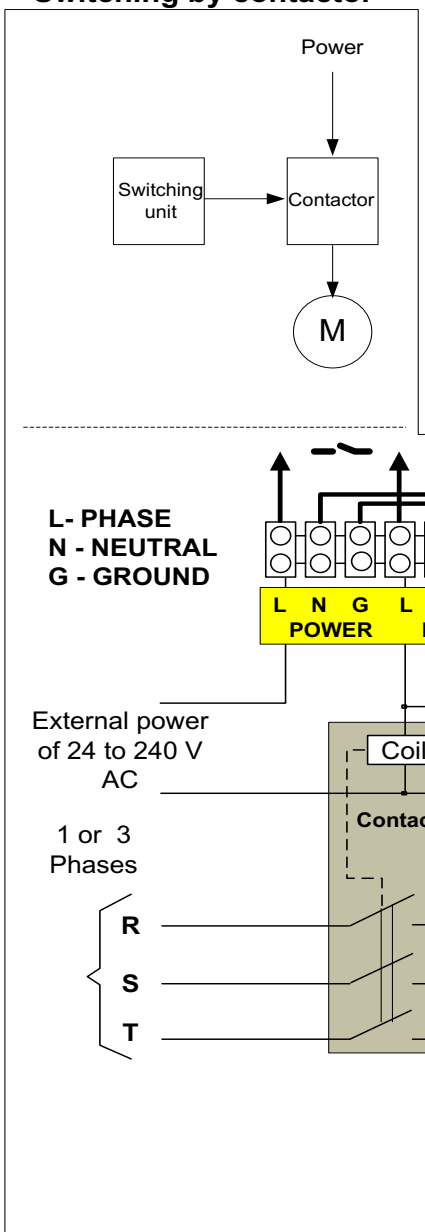


AC PUMP SWITCHING UNIT

AC PUMP SWITCHING UNIT

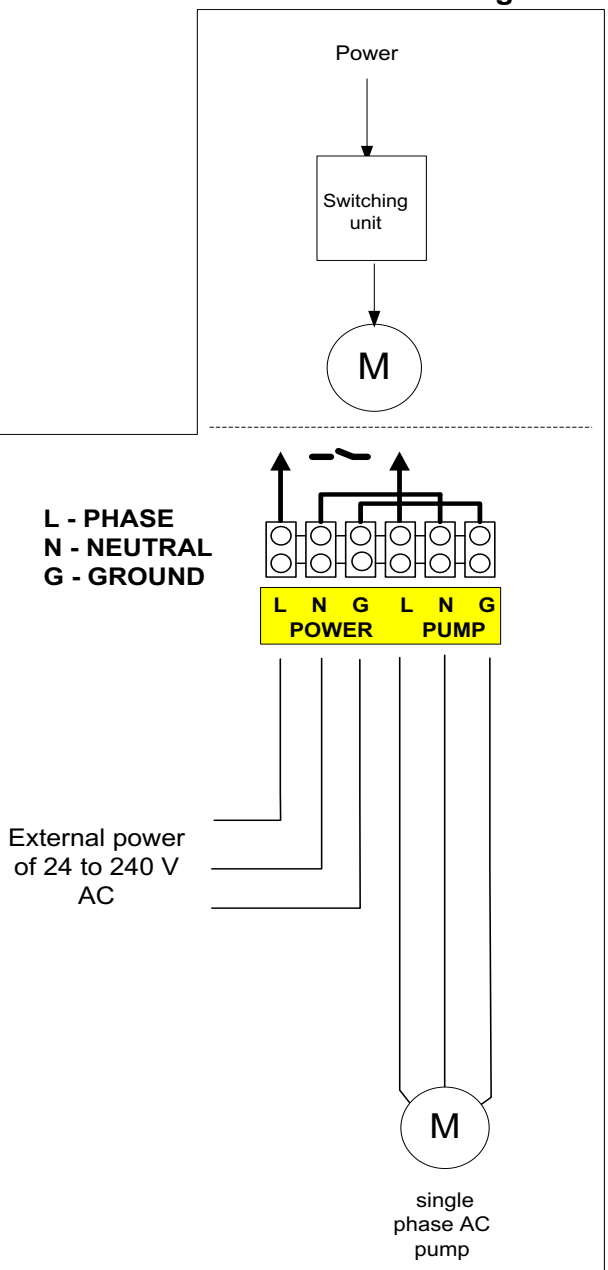
1. **The internal contact of the solid state relay can not be tested by Ohm meter.**
2. **Trying to switch the pump directly from the controller's output without the switching unit, may result in disturbences with the controller's operation.**

Option A
Switching by contactor



Switching the pump through a contactor, usually requires a capacitor of 1 µF to be connected in parallel with the contactor's coil.

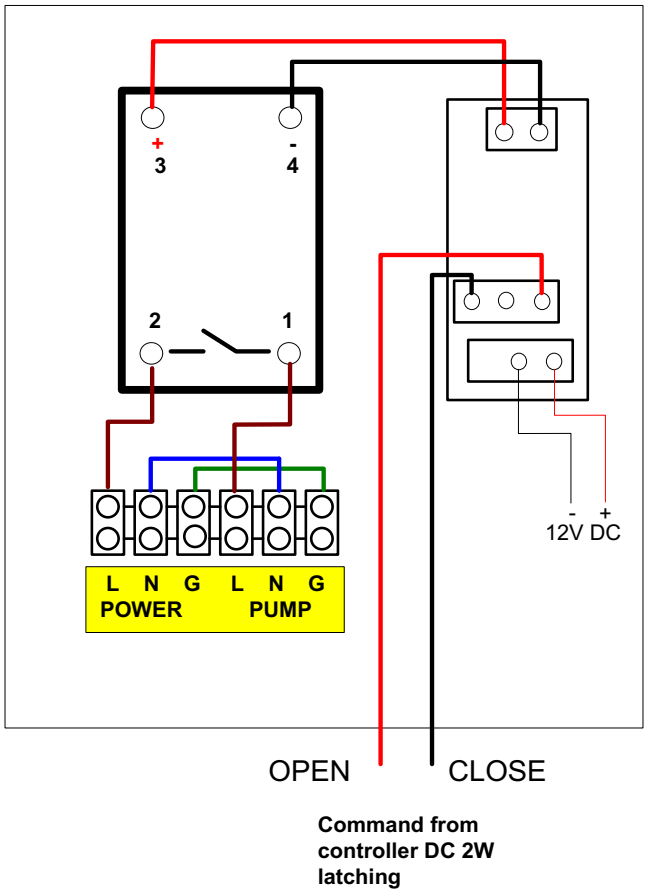
Option B
Direct switching



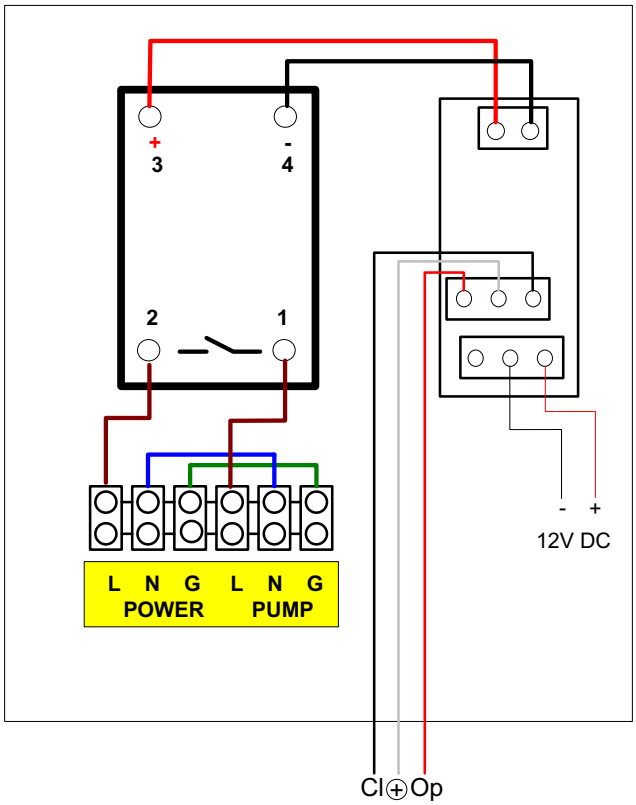
Directly switching the energy for single phase pumps between 24 to 240v AC and up to 10 A.

DC PUMP SWITCHING UNIT

Everything explained above about the AC pump-switching units holds also for the DC type except for the command. As mentioned above the DC pump-switching units are ready for receiving command from controllers using 2 wired or 3 wired DC latching outputs. The only difference is in the connection of the command wires. The following drawings demonstrate this difference.



Command from controller DC 2W latching



Command from controller DC 3W latching

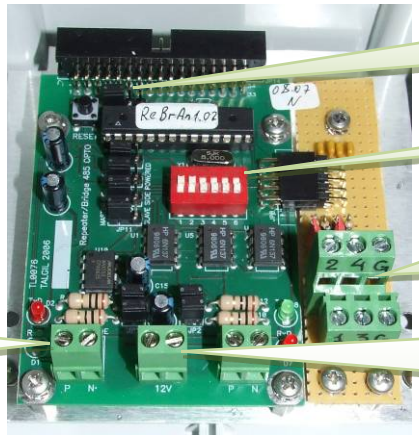
IMPORTANT: It is important to point out that unlike the AC type pump-switching units, the DC type units require a power supply of 12v DC without which they would not function. When the pump-switching unit is commanded by the local I/O of the DREAM or the remote I/O expansion unit, the 12v can be taken from the power supply of the DREAM or of the expansion unit. However when the DC pump-switching unit is activated through an RTU (either 2W or RF), the 12v powering cannot be taken from the RTU resources but must be externally supplied by a 2.5W solar panel and a rechargeable battery of 3Ah.

SPECIAL ACCESSORIES

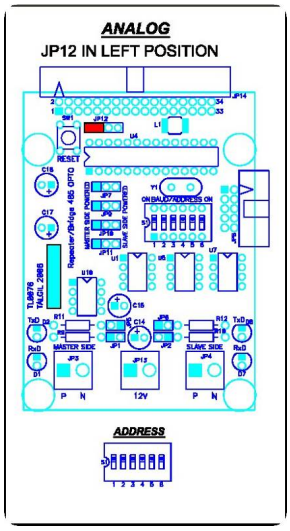
The following paragraph describes 3 special accessories which are all built of the same electronic board but with different setting of the jumpers onboard they fulfill totally different functions.

2 OR 4 ANALOG INPUTS INTERFACE

The first function of the special accessories board is an interface for up to 4 analog inputs that can be plugged into the motherboard or connected to the remote I/O RS485 channel, enables the DREAM to read directly the analog inputs of 4-20 mA.



The jumper that decides the functionality of the board to serve as an analog inputs interface is jumper JP12 that should be set as demonstrated in the drawing to the right.

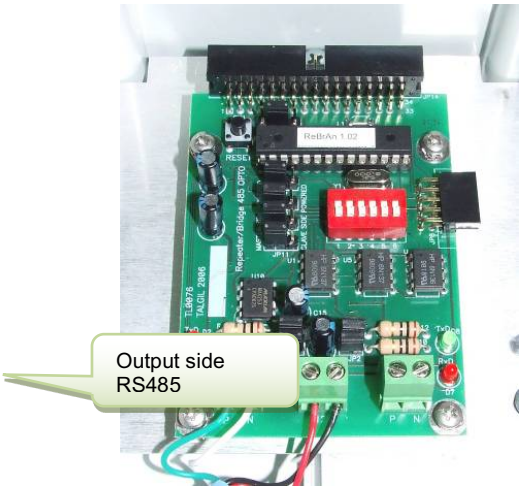


When the board is plugged into the motherboard it does not require connection of the RS485 communication cable and the 12v DC supply (see picture above).

The address switch should be set according to the address given to the analog inputs interface during the "Hardware and connections" definition.

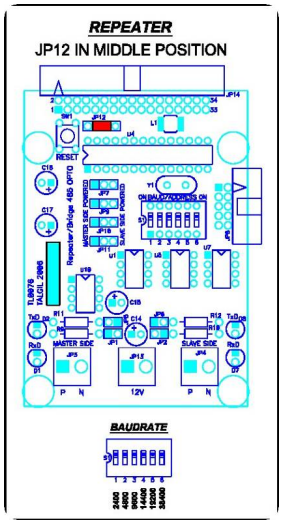
The setting of the other jumpers onboard should be left unchanged.

RS485 REPEATER WITH OPTO ISOLATION



The second function of the special accessories board is to serve as a repeater in the communication line of RS485. When serving as a repeater, the connection between the input and the output of the unit is optic connection only, therefore it supplies good galvanic isolation between the input and the output lines. This feature helps to overcome problems created by problematic lines that create communication difficulties.

JP12 set for Repeater



The picture above shows the input side and the output side but actually, they can be interchanged.

Once again, the jumper, which defines the functionality of the board and makes it a Repeater, is jumper JP12. The setting should be in middle position as shown in the drawing to the right.

A repeater may be needed in two cases:
When the RS485 line gives poor results and the signal needs strengthening.
When the system contains several 2 wired interfaces. Except for the first interface, which is fed directly from the DREAM all the others will be fed separately and will have their RS485 communication line isolated by repeaters.

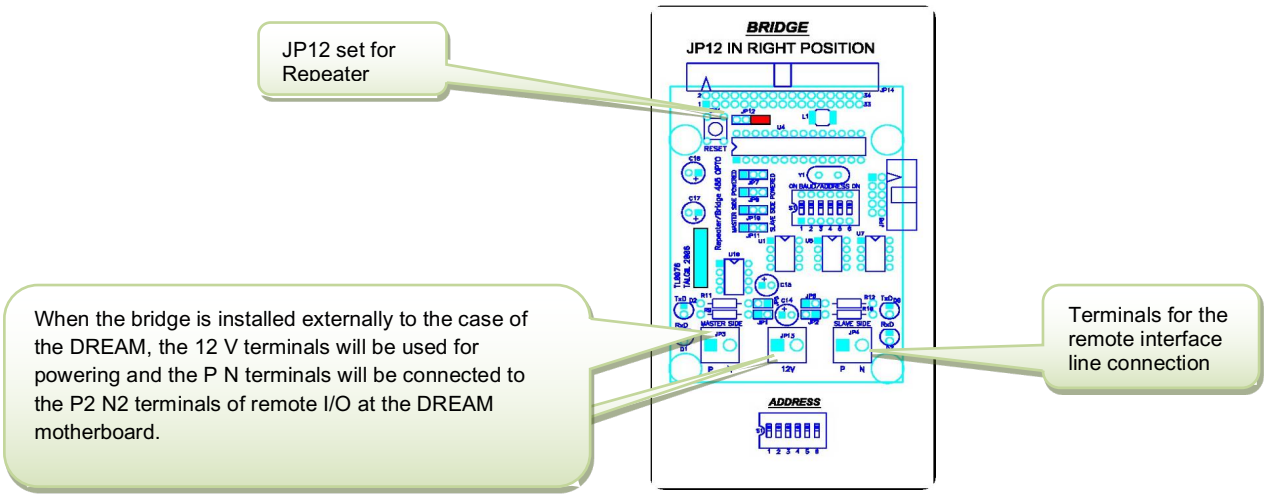
In the second case, we want to eliminate influences between the various two wired lines, therefore we create galvanic isolation between them. In this case, there is a great importance to the feeding of the repeater unit with the 12v DC from the side of the output where the 2W interface is connected and not the side of the input, which arrives from the DREAM. Otherwise, we shall loose the effect of isolation. For this purpose, the repeater board has the ability to be powered either from the input side or from the output side while the two sides remain galvanically isolated. For setting the feeding from the output side, the 4 jumpers JP7,JP9, JP10, JP11 should be in right position (opposite to what appears in the picture above).
The dipswitch in this case functions as a baud rate selector with the following options:

1-2400
2-4800
3-9600
4-14400
5-19200
6-28400

In the DREAM system the baud rate used is 9600 baud.

RS485 BRIDGE

The third function of the special accessories board is to serve as a bridge on the RS485 communication line between the DREAM and remote interfaces. The bridge is plugged on one side into the DREAM'S motherboard and on the other side it is connected to the remote interfaces. It is important to set the address switch of the Bridge to an address equal to that of the interface with the lowest address working through the bridge.
The connection of the remote interface line will be to the right side terminals.



PULSES DIVIDER

The purpose of the pulses divider unit is to enable reading short or high rate pulses by controllers having a scanning rate of once in a second or lower.

The unit will receive the inputs from devices such as water meters or fertilizer meters, count the pulses and emit a symmetric pulse per each "x" pulses counted, based on the selected setting. A special case is when x equals 1, then for each pulse received at the input there will be one pulse generated as output (not necessarily symmetric) whose width will be 1 second. This way even if the input pulse was narrow the output pulse will be wide enough not to be missed by the controller. Obviously, the pulse rate in this case cannot be higher than one pulse every 2 seconds.

In order to cover a wider range of division values, there are two "OPERATION TABLES". The effective table is select by jumper (JP5). The active entry of the table depends on the setting of dipswitch S1.

In the following tables, the Division factor defines how many input pulses will be represented by each output pulse.

OPERATION TABLE 1
JP5 with lower pin free

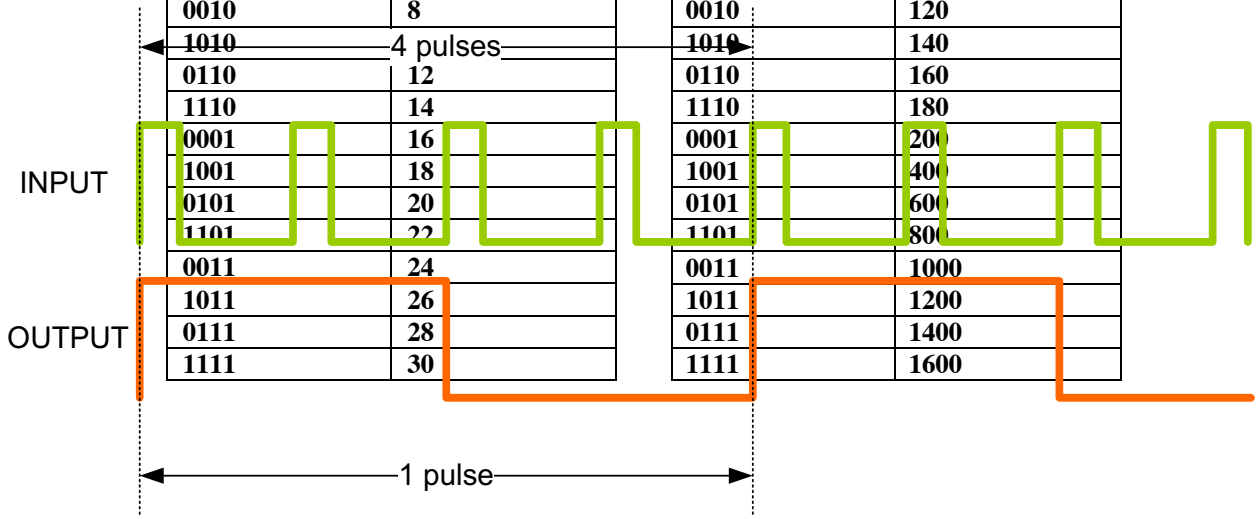
Dip Switch S1	Division factor
0000	1
1000	2
0100	4
1100	6
0010	8
1010	10
0110	12
1110	14
0001	16
1001	18
0101	20
1101	22
0011	24
1011	26
0111	28
1111	30

OPERATION TABLE 2
JP5 with higher pin free

Dip Switch S1	Division factor
0000	40
1000	60
0100	80
1100	100
0010	120
1010	140
0110	160
1110	180
0001	200
1001	400
0101	600
1101	800
0011	1000
1011	1200
0111	1400
1111	1600

EXAMPLE

Let's assume that JP5 is set with the lower pin free and S1 has the following setting: 0100. TABLE 1 is selected, and the division factor is 4, hence for each 4 pulses at the input, 1 output pulse will be generated.



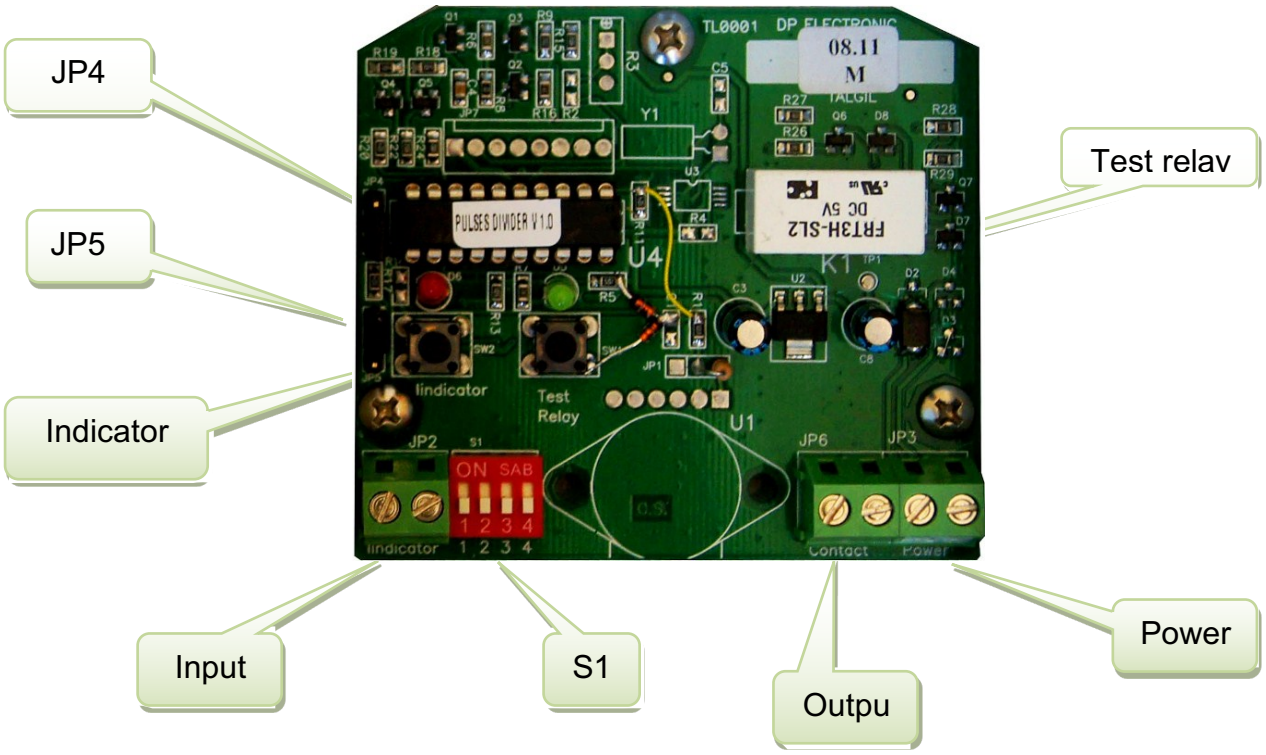
here are 2 LED indications, the RED represents the input and the GREEN represents the output. Regularly each LED blinks a short blink whenever a pulse is detected or emitted. However when the "Indicator" button is pushed and held down, the LEDs show the current status of the input or the output, a closed contact is indicated by LED = ON, and open contact is indicated by LED = OFF.

JP4 – Enables (free upper pin)/ Disables (free lower pin) the LEDs operation.
JP5 – Selects the active OPERATION TABLE as described above, Table 1 is selected when the lower pin is free and Table 2 is selected when the upper pin free.

There are 2 push buttons, one is called "Indicator" and the other is called "Test relay". The "indicator" changes the indication of the LEDs as described above, and the "Test relay" activates the output while pushed.

The two buttons function only during the first 2 minutes after energizing the unit. For being able to reuse the buttons after the unit was energized, disconnect the energy, wait one minute and reconnect the energy.

The unit can be powered either by 6v DC or 12v DC.



Appendix "A" – DECIMAL TO BINARY CONVERTION

In the following table a switch ON is marked by 1 and a switch OFF by 0.

Decimal address	Binary value set by the Dip Switch Positions: 1 2 3 4 5 6	Decimal address	Binary value set by the Dip Switch Positions: 1 2 3 4 5 6
1	1 0 0 0 0 0	31	1 1 1 1 1 0
2	0 1 0 0 0 0	32	0 0 0 0 0 1
3	1 1 0 0 0 0	33	1 0 0 0 0 1
4	0 0 1 0 0 0	34	0 1 0 0 0 1
5	1 0 1 0 0 0	35	1 1 0 0 0 1
6	0 1 1 0 0 0	36	0 0 1 0 0 1
7	1 1 1 0 0 0	37	1 0 1 0 0 1
8	0 0 0 1 0 0	38	0 1 1 0 0 1
9	1 0 0 1 0 0	39	1 1 1 0 0 1
10	0 1 0 1 0 0	40	0 0 0 1 0 1
11	1 1 0 1 0 0	41	1 0 0 1 0 1
12	0 0 1 1 0 0	42	0 1 0 1 0 1
13	1 0 1 1 0 0	43	1 1 0 1 0 1
14	0 1 1 1 0 0	44	0 0 1 1 0 1
15	1 1 1 1 0 0	45	1 0 1 1 0 1
16	0 0 0 0 1 0	46	0 1 1 1 0 1
17	1 0 0 0 1 0	47	1 1 1 1 0 1
18	0 1 0 0 1 0	48	0 0 0 0 1 1
19	1 1 0 0 1 0	49	1 0 0 0 1 1
20	0 0 1 0 1 0	50	0 1 0 0 1 1
21	1 0 1 0 1 0	51	1 1 0 0 1 1
22	0 1 1 0 1 0	52	0 0 1 0 1 1
23	1 1 1 0 1 0	53	1 0 1 0 1 1
24	0 0 0 1 1 0	54	0 1 1 0 1 1
25	1 0 0 1 1 0	55	1 1 1 0 1 1
26	0 1 0 1 1 0	56	0 0 0 1 1 1
27	1 1 0 1 1 0	57	1 0 0 1 1 1
28	0 0 1 1 1 0	58	0 1 0 1 1 1
29	1 0 1 1 1 0	59	1 1 0 1 1 1
30	0 1 1 1 1 0	60	0 0 1 1 1 1

Appendix "B" – RULES ABOUT CABLES

The following rules must be obeyed when using long cables in the DREAM system:

- Never mix in one cable two lines of separate 2w channels.
- Never mix in the same cable a 2 wired channel and an RS485 communication line.
- Always maintain a distance of at least 20 cm between the cables of different 2W channels and RS485 when laid in the ground.
- For laying cable in the ground always used double-coated NYY cables.
- The recommended cable thickness is 1.5 mm^2
- For the 2W channels the cable capacity is of great importance, the lower the better. A capacity of 0.1 μF per km is OK. The total capacity of the cables connected to the "interface 2W" should not exceed 1 μF.
- The resistance of the cable should be reasonably low, with no leakage between the wires and between each wire to the ground. (see testing below).

CABLE RESISTANCE TESTING

1. The cable must be tested for continuity of its wires, and for having good isolation between the wires and between each wire and the ground.
2. Disconnect both ends of the cable under test (including from any RTU in the middle) and make sure the wires are not touching each other.
3. Check the resistance between the wires. Use the highest range available on the ohmmeter (tens or hundreds of KΩ). The resistance should be infinite or at least not lower than 1 MΩ.
4. Check the resistance between each wire to the ground Use the highest range available on the ohmmeter (tens or hundreds of KΩ). The resistance should be infinite or at least not lower than 1 MΩ.
5. Make a short circuit between the wires at one end of the cable and test the resistance between the wires at the other end. This time use the lowest range of your ohmmeter (tens or hundreds of Ω). The resistance between a pair of wires increases with the length of the wires and decreases with their thickness. For 1 Km distance and with a pair of wires with 1.5 mm^2 cross section the resistance should be about 22Ω. The formula for calculating the expected resistance of a pair of copper wires is the following:

$$\text{Resistance (in } \Omega) = \frac{0.017 \times \text{Length (in meters)}}{\text{Cross section (in } mm^2)}$$

This information is entered into the Dream 2 during commissioning

Valve #	Int ADD	RTU #	Out #	Valve #	Int ADD	RTU #	Out #

Notes: