

## BUILDING A SYSTEM WITH MULTI CONTROL



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# 1. CONSTRUCTION OF THE COMPRESSED-AIR INSTALLATION

## 1.1 *Installing the compressors*

ALWAYS equip the system with a pressure transmitter in the first receiver after the compressors. This is called the system pressure sensor.

There can be NO takeout for air between the compressors and the first receiver.

The receiver volume to be entered into the control of the SYSTEM SETUP is ALWAYS and solely referring to the first receiver.

Due to pressure loss in the system, the internal pressure stage of the compressor HAS TO BE higher than the desired end pressure. E.g. the pressure stage of the compressor is set to 10 bar if the desired end pressure is 8 bar.

The maximum pressure of the compressor is set 0.5 bar below the pressure of the safety valve in the COMPRESSOR SETUP. This means that a compressor of 10 bar has a working pressure of 10 bar, a maximum pressure of 11.5 bar (COMPRESSOR SETUP) and a safety valve of 12 bar.

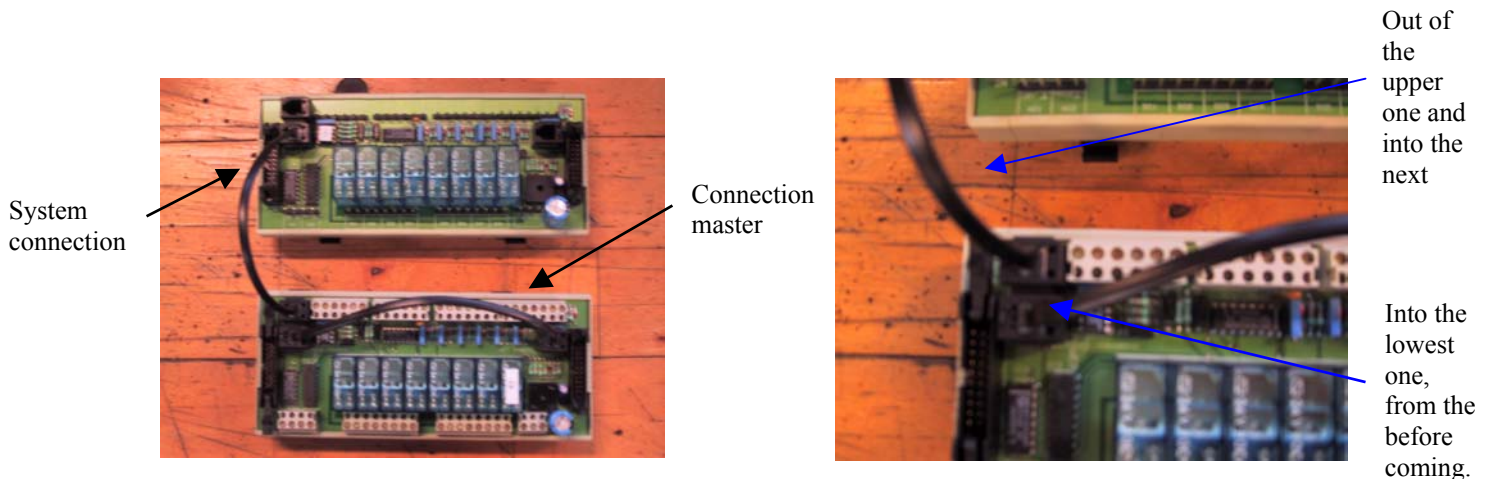
**NOTE;** That if the compressor operates according to the system pressure, the pressure loss between compressor and receiver has to be taken into consideration due to power supply and safety valve!!

## 2. SETTING UP MULTI CONTROL

### 2.1 MASTER

The first compressor in the chain is always the MASTER.

The MASTER supplies the compressor system with power for the communication.



SYSTEM PRESSURE can be connected to any compressor in the chain. If possible however, it should be connected to the MASTER to minimise the error range

RECEIVER VOLUME is solely referring to the volume of the first receiver of the installation in which the pressure transmitter is fitted.

Set up the compressors to single compressor control mode before setting up MULTI CONTROL. This is done to make sure that the compressors “fit” the compressed-air system if MULTI CONTROL should turn off due to failure.

In SYSTEM SETUP, the compressor controlling the system is set to MASTER = YES and to MULTI CONTROL = YES. If the compressor has been fitted with a system pressure sensor, this is set to SYSTEM PRESSURE = YES in SYSTEM SETUP.

The receiver volume is set to the MASTER in SYSTEM SETUP.

### 2.2 SLAVE – The SP/CK series

The SLAVE compressor is set up from the MASTER via the menu MACHINE SELECTION. When a new compressor is to be attached, the control will ask if it should “set addresses?”. The answer to this question is OK. The compressor in question is given a “machine number” and the compressor for setting up with MACHINE SELECTION can be selected.

In the menu SYSTEM SETUP, SLAVES are set to REMOTE = YES and MULTI CONTROL=YES. The capacity of the compressor is entered in the COMPRESSOR SETUP menu and the compressor can be assigned a priority in the menu MULTI CONTROL. If it should solely be possible to control the compressor from the MASTER by means of a remote control, only REMOTE is set to YES.

### **2.3 SLAVE – Any compressor**

Fit a satellite unit between the compressors control and the pressure switch if the compressor is not a SP or a CK model. Further, use a satellite unit for pressure transmitter if the compressor is equipped with a pressure transmitter; see wiring diagram T63773 for further information.

## **3. FLOW RULES**

### **3.1 Single compressor control**

Flow start works so that when the compressor reaches its maximum pressure (cut out) and operates in unload mode if the flow exceeds the set value with 50-99% of the compressors capacity, the compressor starts before the minimum pressure has been reached. This is done to avoid pressure drops due to consumption peaks. Flow start can be turned OFF and this should be done in connection with low capacity compressors.

### **3.2 Multi control**

A 10% rule ensures that compressors are not activated in connection with a low consumption.

No additional machine is activated if the consumption is less than 10% of the operating compressors' capacities according to three consecutive calculations, unless Pstart has been reached. This is to avoid an unnecessary activation of a compressor that would soon have to be stopped again.

### **3.3 Start delay**

START DELAY is the time between the starting of two compressors and works solely to protect the system against too high current peaks. START DELAY should always be set to the compressor with the longest star-delta time. This is the case, because a MASTER waits the START DELAY times two for a SLAVE to start, thus sending an operating signal back. If the compressor does not start within this period, the compressor in question will be set to MULTI CONTROL = NO and consequently be omitted from MULTI CONTROL.

### **3.4 Delay**

The delay is the period before the MASTER makes a new decision on whether to start more compressors or not. The longer the pressure delay, the slower the system becomes. The shorter the pressure delay, the faster the system becomes. The length of the pressure delay should match the compressor the furthest away from the receiver, i.e. the time it takes from when the compressor produces air till this air reaches the receiver,

### **3.5 Tolerance and dampening**

TOLERANCE allows the compressor to deviate from its maximum pressure with 0-10% in the DAMPENING period for 0-10 sec. If this period is exceeded, all compressors operate momentarily in unload mode. TOLERANCE and DAMPENING are used to provide a more smooth operation of the compressors in connection with very quick systems.

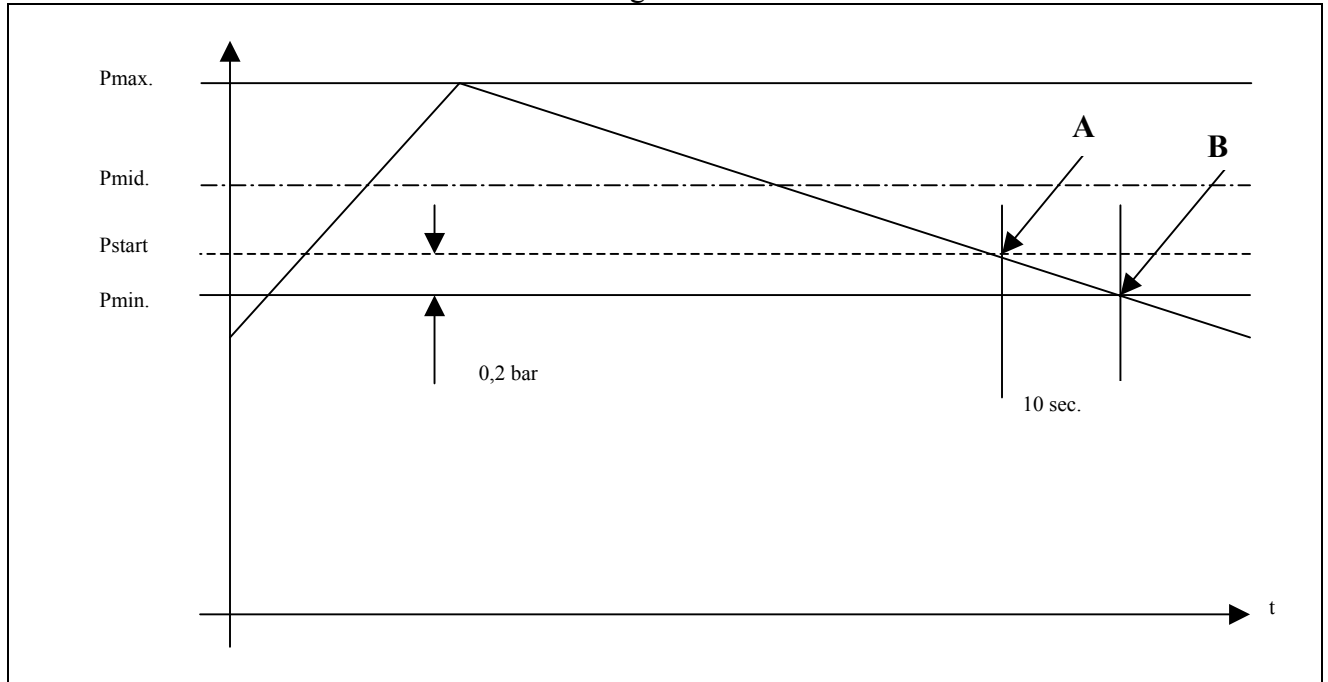
### 3.6 Pstart/Pstop

Pstart and Pstop are variable limits in the controller used for providing a more smooth operation and ensuring that the pressure does not fall below Pmin.

Pstart is a starting time calculated on the basis of the current flow/pressure drop.

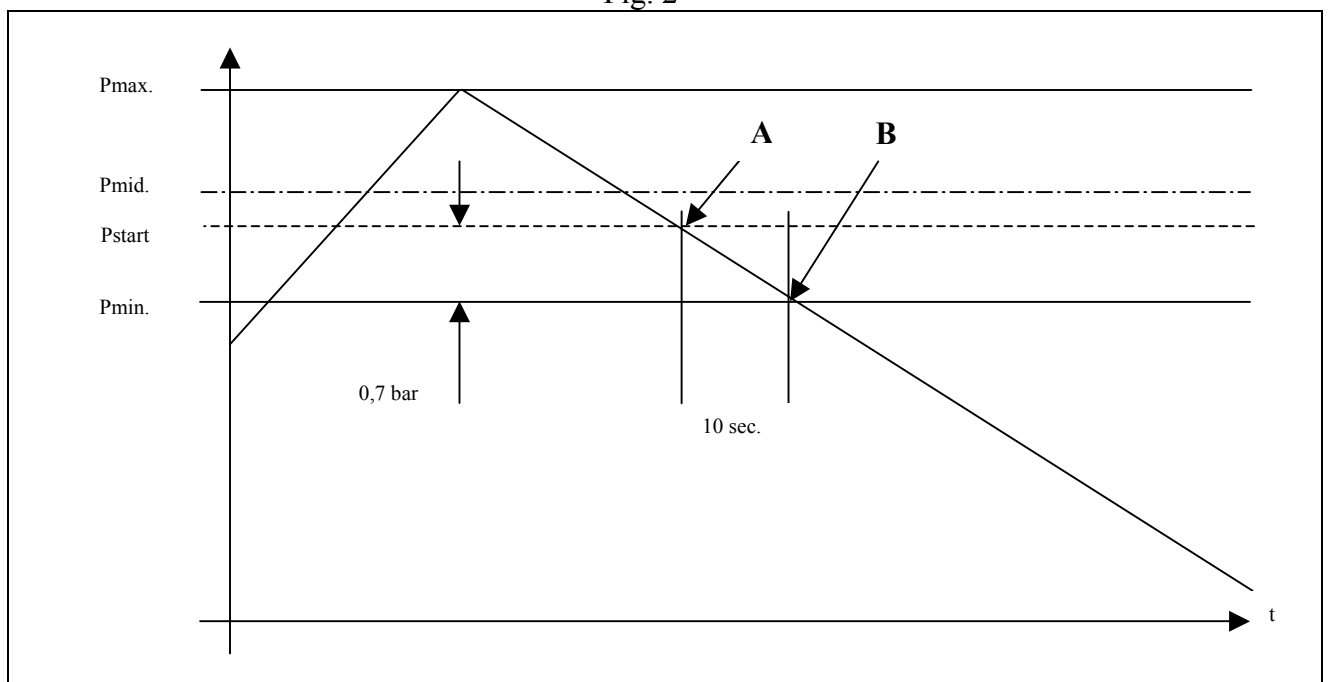
Starting time: From point A it takes the pressure 10 sec. to reach point B, i.e. Pmin, see fig. 1

Fig. 1



In connection with a large flow/consumption, the Pstart limit will move up the pressure curve, which means that the compressors will start earlier, see fig. 2

Fig. 2



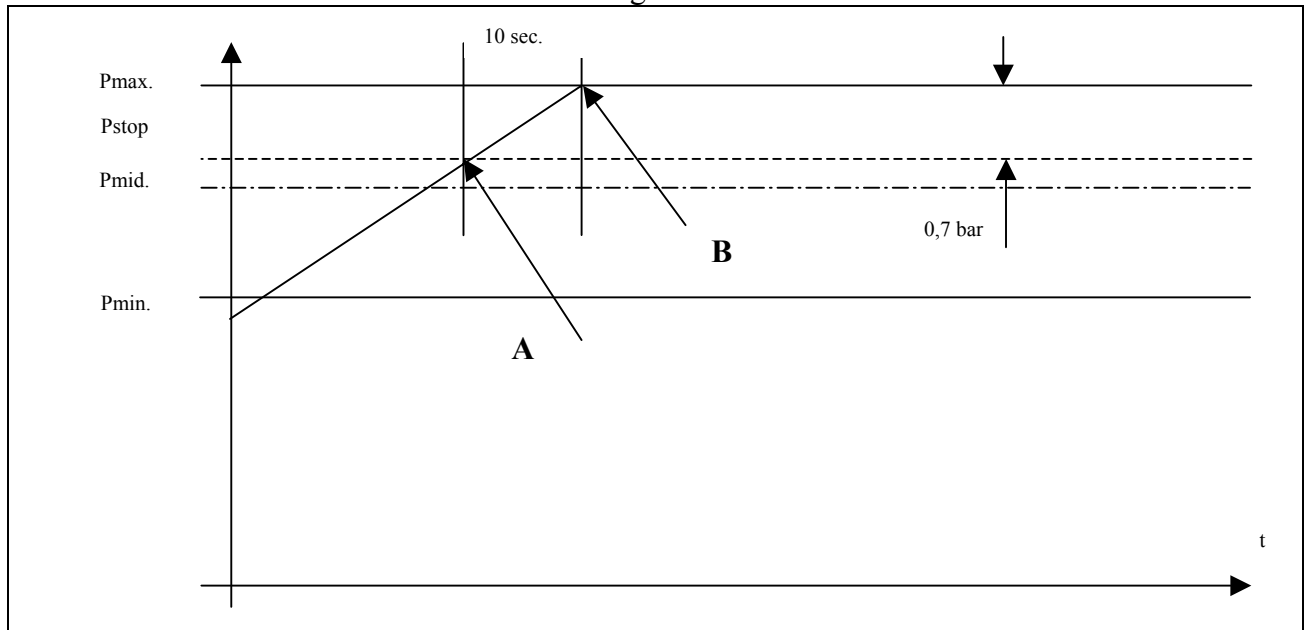
Example 1: At a flow of 2 m<sup>3</sup>/min. Pstart could be 0,2 bar above Pmin (see fig. 1) and at a flow of 4.5 m<sup>3</sup>/min. Pstart could be 0.7 bar above Pmin (see fig. 2). The Pstart limit however, can never be above Pmid.  $P_{mid} = \frac{P_{max} + P_{min}}{2}$

Pstop works contrary to Pstart, which means that in connection with a large flow, the compressor that was started the latest, stops close to Pmax and in connection with a small flow, the compressor is stopped earlier. It will however, never be possible to stop it below Pmid.

Pstop is a stopping time calculated on the basis of the current flow/pressure rise.

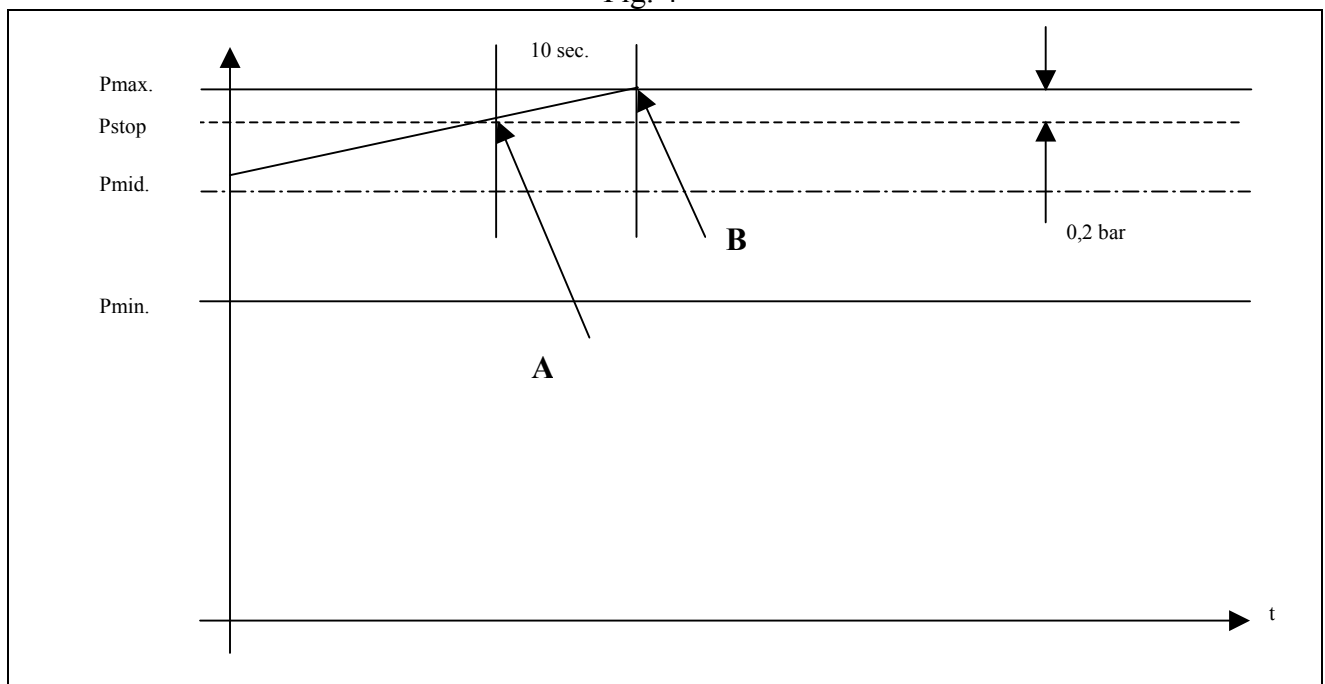
Stopping time: From point A it takes the pressure 10 sec. to reach point B, i.e. Pmax, see fig. 3

Fig. 3



In connection with a small flow/consumption, the Pstop limit will move up the pressure curve, thus stopping the compressors later, see fig. 4

Fig. 4





Example 2: At a flow of 2 m<sup>3</sup>/min. P<sub>stop</sub> could be 0.7 bar below P<sub>max</sub> (see fig. 3) and at a flow of 4.5 m<sup>3</sup>/min. P<sub>stop</sub> could be 0.2 bar below P<sub>max</sub> (see fig. 4). The P<sub>stop</sub> limit however, can never be below P<sub>mid</sub>.  $P_{mid} = \frac{P_{max} + P_{min}}{2}$

## **4. CONTROL MODES**

### ***4.1 Priority control:***

The compressors are assigned priorities. The compressor(s) with first priority will always start the first whereupon the compressors with lower priorities are started. The priority is assigned in the menu MULTI CONTROL. STRATEGY is set to rotation.

### ***4.2 Rotation control***

The compressors are rotated according to an adjustable interval between 1 and 256 hours. If the compressors move more than two times the interval apart, the starting sequence of the compressors in question is inversed. Check that all compressors have the same priority.

### ***4.3 Combination of rotation and priority***

If an installation consists of e.g. five compressors with two big compressors for the base load and three small machines for the peak load, the big machines can be assigned first priority and the small machines second priority. Within each priority group, the control will rotate the compressors.

### ***4.4 Energy control***

In connection with starting from minimum, all compressors with capacities corresponding to or equalling the current consumption will start. Then the DELAY period passes before a decision on whether or not more compressors should be started is made.

To make the system more flexible and avoid momentary unload operation for all compressors in connection with maximum pressure; TOLERANCE in % and DAMPENING in sec. has been introduced.

The system starts again as soon as the system pressure reaches Pstart.

In connection with starting from the minimum pressure, the compressor with a capacity corresponding to or bigger than the current consumption of air is started. If none of the compressors are big enough, the biggest of them is started whereupon a decision on what compressor to start next is normally made. A compressor with a frequency inverter has first priority.

## **5. FAILURE SITUATIONS IN CONNECTION WITH MULTI CONTROL**

### **5.1 Alarm**

If the MASTER of a system is deactivated due to an alarm, the remaining compressors in the system return to their own pressure switch or pressure transmitter. Set the MASTER to MULTI CONTROL=YES in SYSTEM SETUP after troubleshooting.

If the compressor carrying the system pressure sensor is deactivated due to an alarm, all the compressors in the system will return to their own pressure switch or pressure transmitter. Set the compressor carrying the pressure transmitter to MULTI CONTROL=YES in SYSTEM SETUP after troubleshooting.

If there is an alarm on a single compressor in the chain whereupon this compressor stops, the remaining compressors in the system will continue. When the failure has been corrected, the machine in question is set to MULTI CONTROL =YES in SYSTEM SETUP and the compressor will re-establish itself.

If a SLAVE satellite has an alarm output on its own control, this signal can be passed on to DI1 on the satellite unit, thus informing the MASTER that the specific compressor has an alarm whereupon the compressor will be omitted from MULTI CONTROL. Also, the MASTER can pass on a signal through DO7 for external alarm.

### **5.2 System connection**

If the system connection between the two compressors is broken, the subsequent compressors in the system will return to their own pressure switch or pressure transmitter and continue. When the system connection has been restored, the system will re-establish itself.

### **5.3 Power failure**

If the entire system is deactivated due to power failure, the system is restarted at the master when the power returns.

If the power failure only concerns a single compressor in the chain, the remaining compressors will continue. When the power returns, the system re-establishes itself.

## 6. SETTING THE SYSTEM

If four compressors in an installation of five machines supply the production with air and the fifth compressor supplies a spray-painting booth with air and otherwise works independently from the others, a receiver of 3,000 l is placed next to the compressors supplying the production and a receiver of 1,000 l is placed next to the fifth compressor.

The compressors are set as shown below. The MASTER is not placed the closest to the system receiver but the system pressure is connected to it on terminal AI2. NOTE that in connection with multi control only one machine is equipped with SYSTEM PRESSURE! Machine No. 5 has been equipped with a system pressure sensor but does NOT operate in multi control mode. The system pressure transmitter is connected to AI2 on machine No. 5. This ensures that the necessary pressure is present in the receiver.

	MASTER 1	SLAVE 2	SLAVE 3	SLAVE 4	REMOTE 5
RECEIVER	3,000	----	----	----	1,000
REMOTE	YES	YES	YES	YES	YES (*)
AUTO START	NO	NO	NO	NO	NO
MULTI CONTROL	YES	YES	YES	YES	NO
MASTER	YES	NO	NO	NO	NO
SYSTEM PRESSURE	YES	NO	NO	NO	YES

(\*) Set REMOTE=YES to start the compressor manually and stop it from the MASTER

### 6.1 Remote control and alarm

If a production works in two shifts where overtime occurs, a switch can be fitted in the workshop, making it possible to turn on the compressor system outside of normal working hours. The switch is connected to the potential free relay DI7 on the main card of the MASTER. Set REMOTE=YES in SYSTEM SETUP on the MASTER.

If it is desired to connect the compressor to an alarm that will make it possible to switch compressor failure, the alarm is connected to the potential free DO7 relay on the main card of the MASTER.

### 6.2 Schedule

It is no secret that minor air leakages occur in the compressed-air system and to avoid an unnecessary energy consumption because the compressors produce air after working hours it is possible to stop the compressors when the production stops by means of the SCHEDULE.

Set SCHEDULE = YES in the MAIN menu on the MASTER and set time for production start and stop in the SCHEDULE. Check that date and time have been set correctly in the SYSTEM SETUP.

If the dryer should be shut down for the weekend and after ordinary working hours, despite the danger of bacteria growth, and at the same time start half an hour before the compressors in the morning, this is possible by means of the SCHEDULE.

Set EXTERNAL = NO in the SCHEDULE for the periods when the dryer should be turned off and EXTERNAL = YES for the periods when the dryer should be turned on. The dryer is connected to the potential free relay DO1 on the main card of the MASTER.

### **6.3 Heat exchanger and recovery**

For energy saving, a heat exchanger can be fitted to the compressors. The heated water is used in the production for parts cleaning but the water pump should not operate if the compressors are not fully heated. This is why the pump is connected to relay K4 of the control, thus ensuring that the pump is not operating when the fan in the compressor is running.

To utilise the hot air for heating the dryer, a ducting can be fitted to the compressor supplying the spray-painting booth. An electric valve is placed on the ducting and this valve has to be open when the compressor is operating. Therefore, the electric valve is connected through a relay to the main relay K1, thus ensuring that the valve only opens when the compressor is operating.

## **7. REMOTE CONTROL**

With the controller alone, the control can be used as a remote control or multi control unit.

If the control should be used as a remote control unit, two jumpers have to be fitted to the print. These jumpers have already been fitted if the control has been delivered as a remote control unit. The jumpers allow both system pressure and remote control directly on the controller. The system is built so that the remote control unit is a MASTER and if it is used as a multi control unit it has been fitted with a system pressure sensor. The remaining compressors are SLAVES. Further, the control is set as described in "SETTING THE SYSTEM".

## **8. SERVICE TOOLS AND SPARE PARTS**

### **8.1 Print**

746305 CONTROLLER CARD

746306 MAIN CARD

746299 BOX WITH TEMPERATURE PRINT  
For new temperature sensor type

746307 SATELLITE CARD

746003 PRESSURE SIMULATOR FOR SATELLITE

### **8.2 Microchip**

746311 UPGRADING FOR CONTROLLER  
Used in connection with new software version

746308 MICROCHIP FOR CONTROLLER (MAIN)

746310 MICROCHIP FOR CONTROLLER (SUB)

746309 MICROCHIP FOR MAIN CARD

746328 MICROCHIP FOR SATELLITE CONTROLLER

746300 MICROCHIP FOR TEMPERATURE CARD

### **8.3 Power cable and tools**

746317 CONNECTION CABLE FOR SP CONTROL  
Is used to connect individual compressors (min 100 meters).

746291 CONNECTION CABLE UP TO 10 METER

746292 CONNECTION CABLE UP TO 20 METER

746293 CONNECTION CABLE UP TO 30 METER

746318 CONNECTOR FOR SP CONTROL  
Is used to connect the individual compressors.

746319 PLIERS FOR POWER CABLE  
Is used to shrink the connector on to the power cable.

## **8.4 Remote control unit**

746001 REMOTE CONTROL UNIT FOR SP CONTROL

746312 JUMPERS FOR REMOTE CONTROL UNIT

Is used if a print has to be renewed in a wall type multi control unit.

746313 CONNECTOR FOR REMOTE CONTROL UNIT

Is used to connect a pressure transmitter and a wall type multi control unit.

746289 SATELLITE UNIT WITH PRESSURE SIMULATOR, COMPLETE IN BOX

Is used to connect different types of compressors in multi control units if the compressors are equipped with pressure transmitters.

746290 SATELLITE UNIT, COMPLETE IN BOX

Is used to connect different types of compressors in multi control units if the compressors are equipped with a pressure switches.

## **8.5 Compressor updating**

746296 UPDATE FOR NEW TEMPERATURE SENSOR, CK6-15

746298 UPDATE FOR NEW TEMPERATURE SENSOR, SP20-75

746297 UPDATE FOR NEW TEMPERATURE SENSOR, SP100-150

746280 UPDATE FOR SAFETY THERMOSTAT, SP20-30

746281 UPDATE FOR SAFETY THERMOSTAT, SP40-75

746282 UPDATE FOR SAFETY THERMOSTAT, SP100-150