MDC-Max Configuration Manual

Version 1.30
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Introduction

MDC-Max is a software product that enables companies to monitor their machine tools in real time. It does this by generating messages each time an event occurs (such as the machine starting or stopping) and stores these messages in its database. The MDC-Max client is then used to generate real time status screens and historical reports of machine activity from this database.

In order for MDC-Max to function you must have already installed DNC-Max (version 5 or higher) and configured it to communicate with your machine tools. This manual assumes you have already done this. Many of our dealers have installed MDC systems on manual machines that do not require DNC at all. The process is the same – you must first install DNC-Max and create a working RS232 link to the machine. The DNC-Max server is the central data collection source for all MDC messages so you cannot run MDC-Max without it.

Machine status (running / stopped / alarm) is collected via an MDC box that converts 24v and 110v signals into RS232 status line signals. These are then transmitted via the RS232 interface to DNC-Max. A bar code reader can also be fitted to the MDC box to send additional text strings to DNC-Max (machine in setting mode for example). Some machine tools can print text out of the serial port while the program is running (eg DPRNT on Fanuc, Mazak and other controls) and these are collected by DNC-Max in the same way.

Whenever a string of text or line change is detected by the DNC-Max Server Software it converts these to an MDC-Max message. For example the CTS high signal could be converted to a CYCLESTART message to indicate that the machine is in cycle (running). When the CTS line goes low this could be converted to a CYCLESTOP message.

The first job when installing MDC-Max is to consider what status changes you want to collect from the machine and then what message you want them converted into. Most installations will include CYCLESTART, CYCLESTOP, and PARTCOMPLETE as a minimum.

The Examples in the following pages use three hardware signals:-

CYCLESTART (machine is running)
CYCLESTOP (machine stopped)
PARTCOMPLETE (program cycle complete and part finished)

We also use three signals generated by Bar code or Text Entry:-

SETTING (machine in setting mode)
INSPECTION (machine in Inspection mode)
OKTORUN (machine back in normal run mode)

Chapter 1 – Configuring Messages in DNC-Max

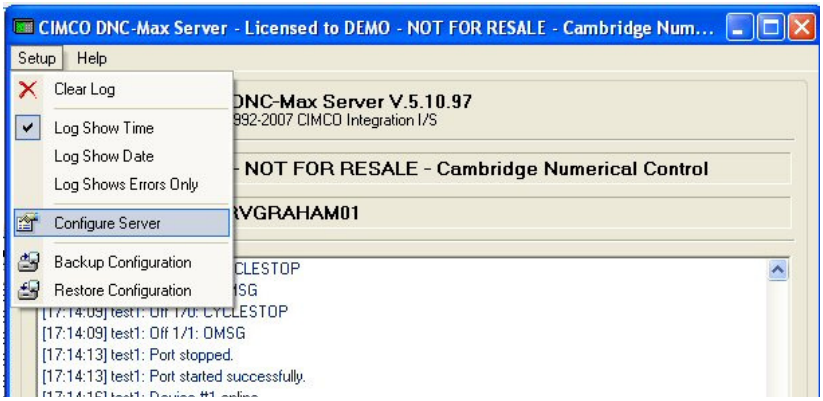
In order for DNC-Max to generate the messages they must be configured in the DNC-Max Server. This is true for all barcode messages, DPRNT messages and hardware MDC messages.

First you must decide which messages you wish to use on the MDC-Max system, additional messages can be added at a later date, but initially the basic monitoring messages and any Bar-code/swipe card messages should be defined.

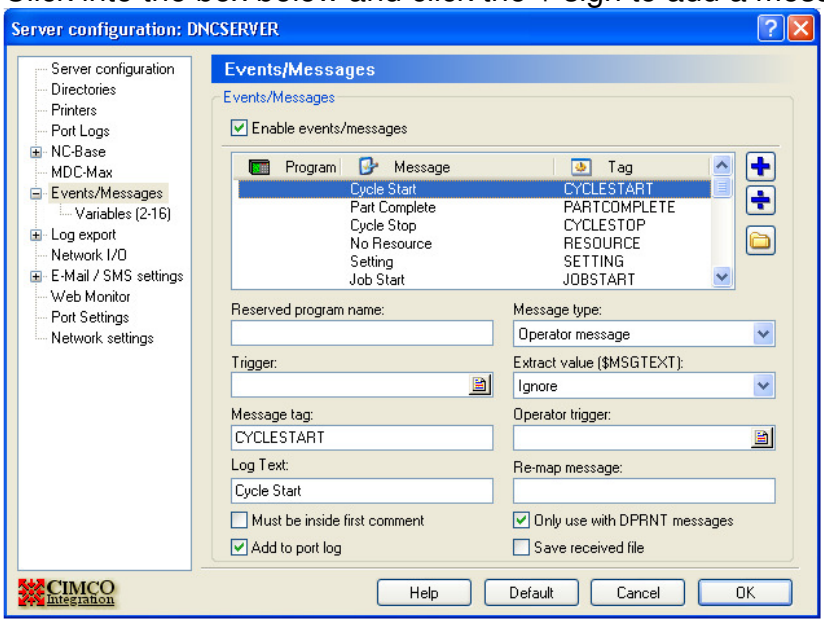
Let's begin by setting up three messages – CYCLESTART, CYCLESTOP and PARTCOMPLETE generated by the MDC hardware box.

1.1 Entering Cycle Start / Stop messages for the MDC hardware box

On the main DNC-Max Server screen click Setup, Configure Server

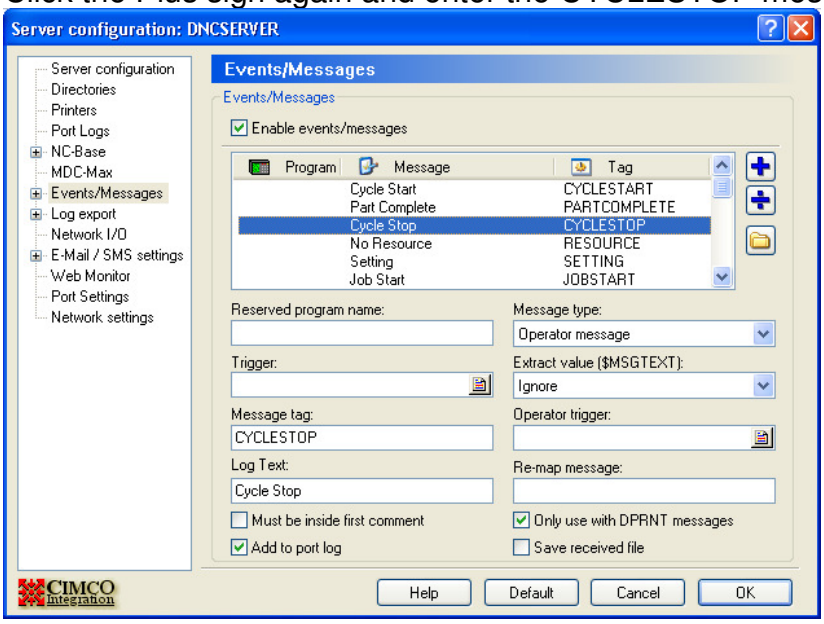


Click Events / Messages and tick Enable events.
Click into the box below and click the + sign to add a message.



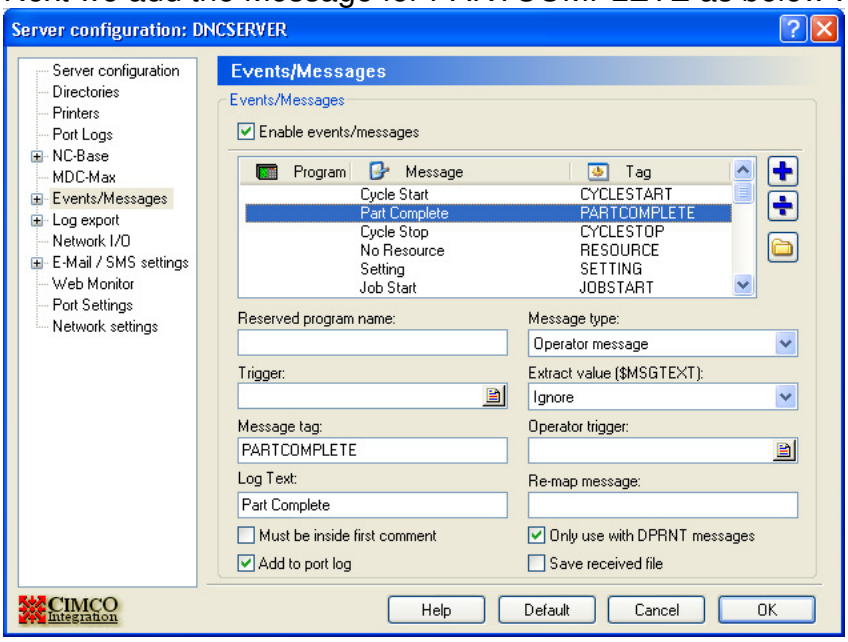
Set the following fields :-
Message Type to Operator Message.
Trigger to blank
Message Tag to be CYCLESTART
Log Text to Cycle Start
Extract Value to Ignore
Tick the “only use in DPRNT messages” box

Click the Plus sign again and enter the CYCLESTOP message as below :



This has now added the two messages generated when the machine starts or stops. We do need two messages as the machine is either running (CYCLESTART) or stopped (CYCLESTOP).

Next we add the Message for PARTCOMPLETE as below :



Now let us explain what the individual fields mean :-

Reserved Program would be used if we wanted to generate a message by punching a program (eg 7990) from the machine so in this case it is blank.

Trigger is any text string that is sent down the RS232 line to generate the message (from a barcode or DPRNT). These three messages are generated by the MDC box directly (line status change) so there is no text and no trigger.

Message tag is the most important part – this is the name of the message itself and must be unique. This MUST be in UPPER case.

Log Text is the text that appears in the MDC-Max event log (not the port log) and is just a comment.

Add to Port log adds the actual message (eg CYCLESTART) to the log for this machine (this is useful for debug but you will probably want to turn this off once the system is running correctly).

Only use with DPRNT must be ticked for this type of message as this makes sure this message will not be triggered by a program transfer.

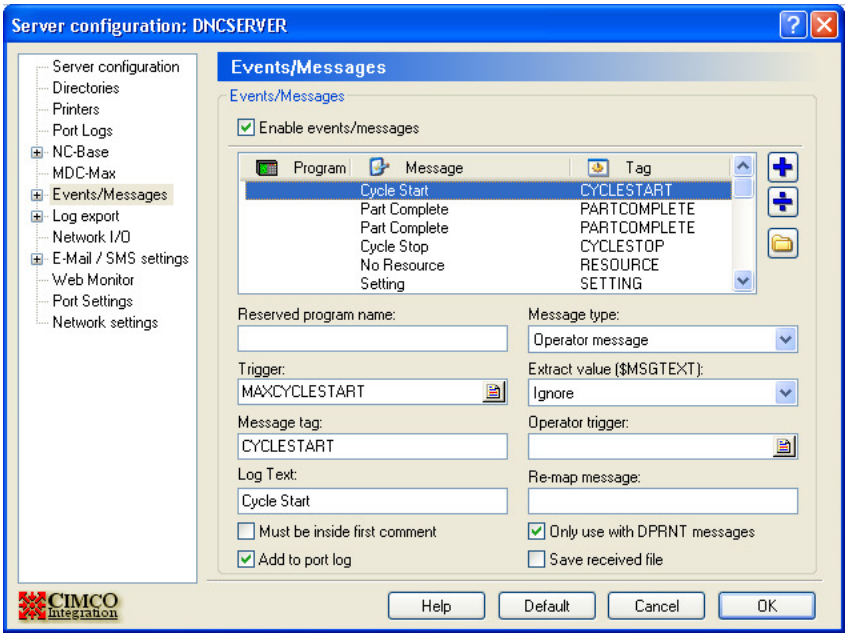
Ignore the other fields for now – we will use them later, just make sure they are set as above.

You now have the 3 basic messages setup and you skip to Chapter 2 if you want to get on with installing the MDC box in the machine.

1.2 Entering Cycle Start / Stop messages for DPRNT statements

Some machines have the facility to print text out of the serial port when a program is running (Fanuc with macro B, Fadal, Mazaks with macro option fitted and Mitsubishi are some that can). This method can be used to indicate when the machine starts and stops instead of a hardware box in the machine. But be aware this means these commands have to be added to each CNC program (DNC-Max can do this for you).

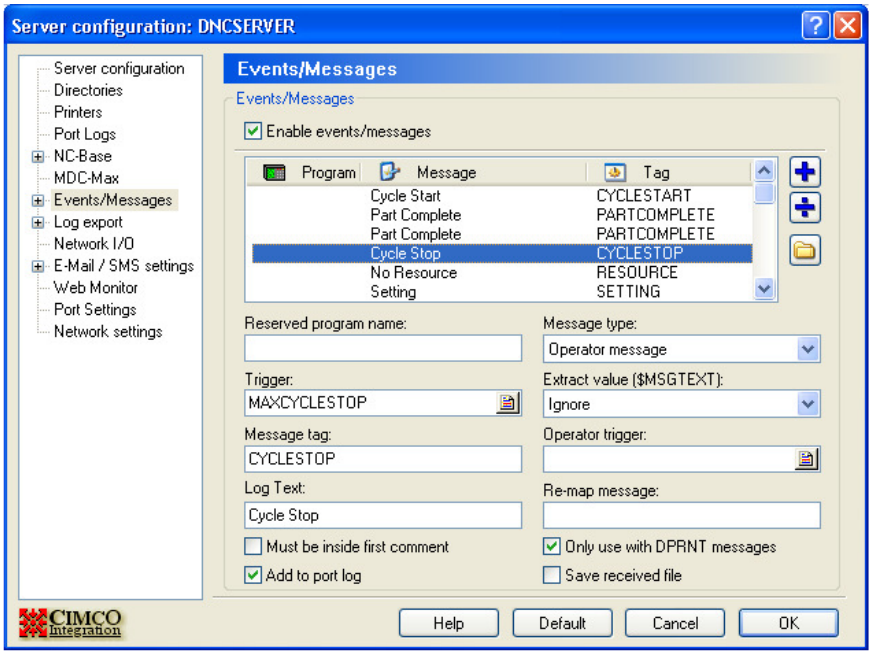
On the main DNC-Max Server screen click Setup, Configure Server.
Click Events / Messages and tick Enable events.
Click into the box below and click the + sign to add a message as before but this time set it up as below

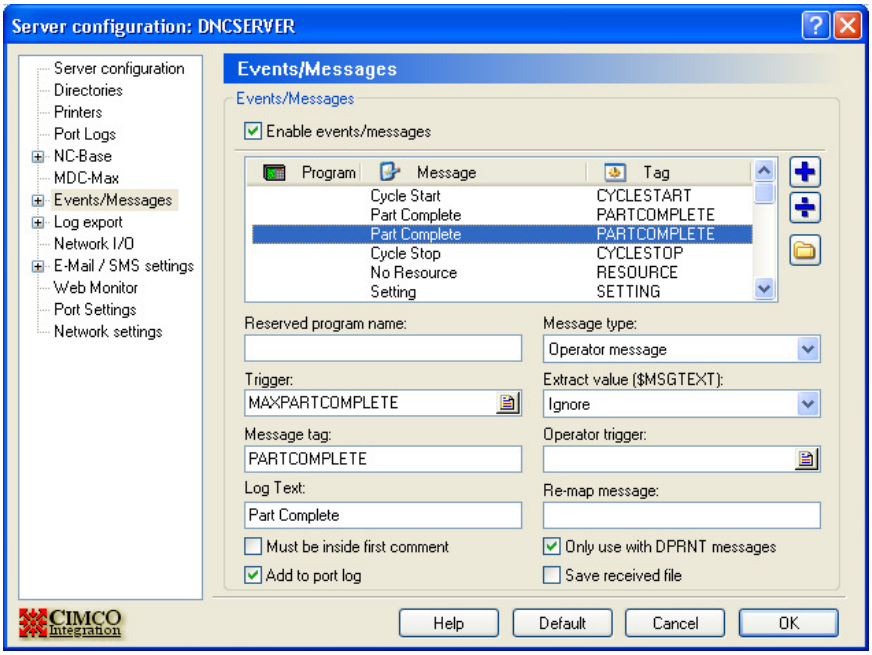


Notice that the only difference to using the MDC-Max box is that the Trigger is set to MAXCYCLESTART, everything else is the same. This means that DNC-Max will look for the exact string “MAXCYCLESTART” coming out of the machine and then generate the CYCLESTART message. Don’t confuse the Trigger string and the message name – they are similar but not the same.

Why MAX? - any text string from the machine or barcode reader that we want to treat as a message trigger has to have a unique prefix string of characters that would not normally appear in the first few lines of a CNC program. Otherwise you could find that receiving a CNC program generates MDC messages as well. We normally use the MAX prefix as it is unusual for this to be at the start of a CNC program but you can use any other unique prefix (avoid the use of MSG as it is used for comments on machines such as the GE2000).

The other messages can be setup in the same way as below





Again the only difference between these setups and the hardware ones is the addition of the Trigger String starting with MAX.

1.3 Example Fanuc DPRNT Program

For this to work we must now enter the print commands into the CNC program – here is a Fanuc example (it is different for other types of control) :-

```
O1234
POPEN                          - Open the RS232 port
DPRNT[MAXCYCLESTART]           - print MAXCYCLESTART
PCLOS                          - Close the port
.
.
 Rest of CNC program
.
POPEN                          - Open the port
DPRNT[MAXPARTCOMPLETE]         - print MAXPARTCOMPLETE
G04 D1000                      - delay for 1 second
DPRNT[MAXCYCLESTOP]            - print MAXCYCLESTOP
PCLOS                          - Close the port
M30
```

Warning : Using this method cannot tell you when the machine stops in the middle of a program as the MAXCYCLESTOP command will never be reached. MDC-Max can get around this by setting a maximum cycle time but it is not as accurate as using an MDC hardware box in the machine.

You can mix and match the hardware and software method on these types of controls. The box tells you when the machine starts and stops and a DPRNT is used to tell you when a palette machine changes palette or a part is completed.

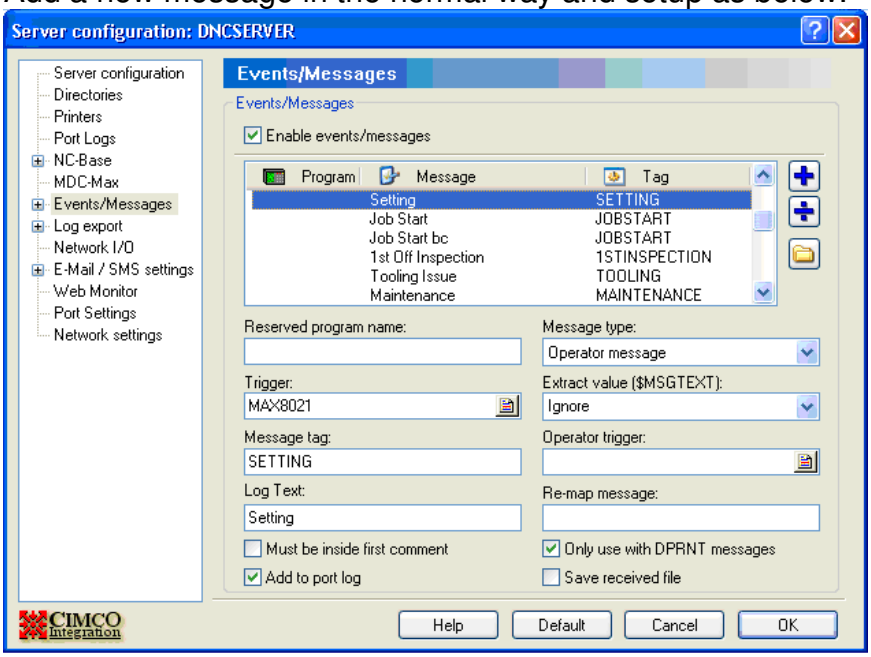
1.4 Entering Barcode messages

Some customers will not only want to know when the machine is running or stopped but also why the machine is stopped. To get this information you can use a bar code reader on each machine or a PC in each machine cell (it can have a touch screen or bar code reader as well).

Either way you have to agree with the customer what reasons they want to capture and create a new message for each reason.

Here we are going to add 2 downtime reason codes which are going to be scanned by barcode reader. The downtime reasons are Setting and Inspection.

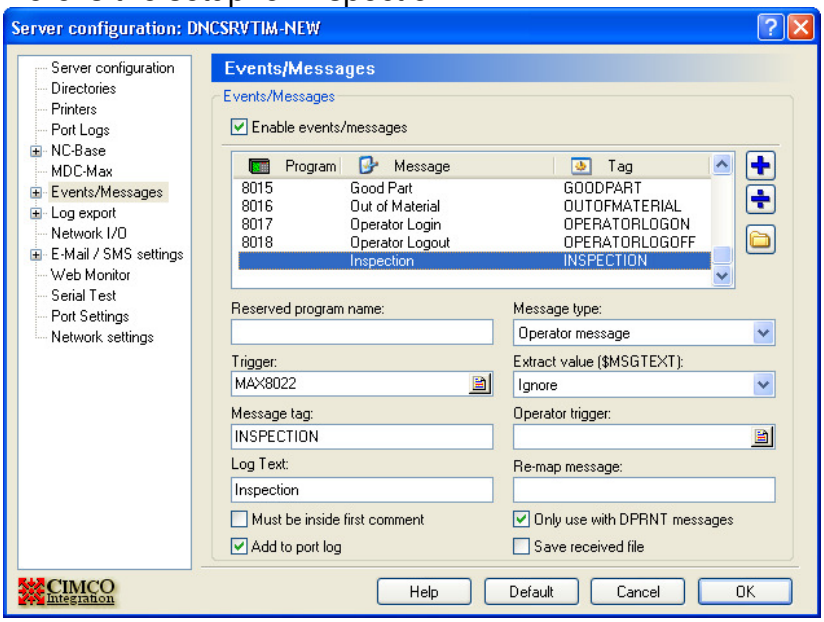
Add a new message in the normal way and setup as below:-



The setup is almost the same as before, the message is SETTING but the Trigger is MAX8021 instead of MAXSETTING. We could have used MAXSETTING but it is best to keep barcode strings short as the printed barcode can become too long to scan.

In the dealer pack you will find a page of example downtime reason codes and their associated barcodes – all of which use a MAX80dd format (where dd is a two digit code). If you stick with this format you will never produce a barcode that is too long to scan.

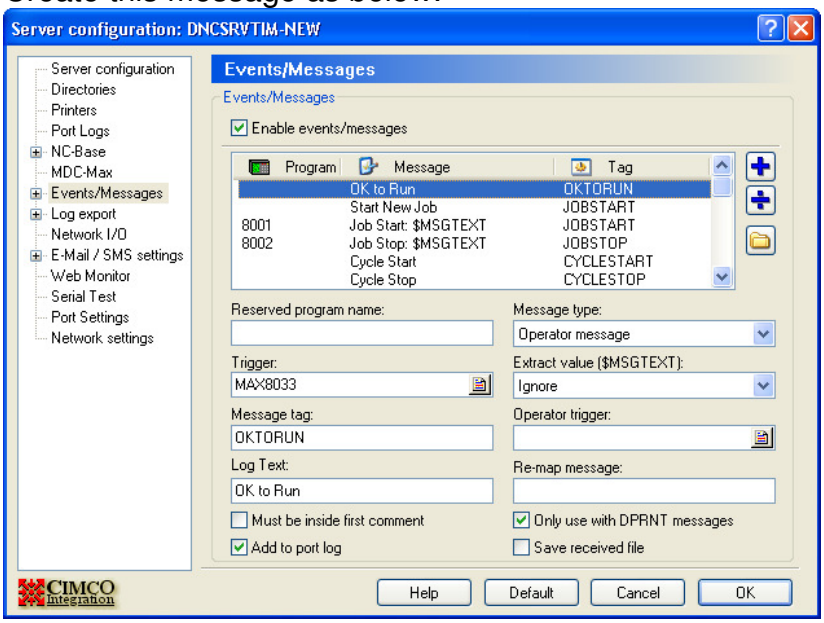
Here is the setup for Inspection:-



When the operator has finished setting he needs a way of telling MDC-Max. We could setup a “STOPSETTING” message and have a barcode for that but then we would also need a “STOPINSPECTION” message. If you have 8 downtime reasons (Eg Maintenance, Tooling Issue etc.) then this quickly becomes confusing and you run out of space on your barcode sheets.

In general the machine will either be in Setting or Inspection so we recommend a single OKTORUN message. This will be used to clear all the downtime reason codes in one go.

Create this message as below:-



Now you are ready to print the barcode sheet to be used with the barcode reader – see the “Preparing Barcode Charts” section.

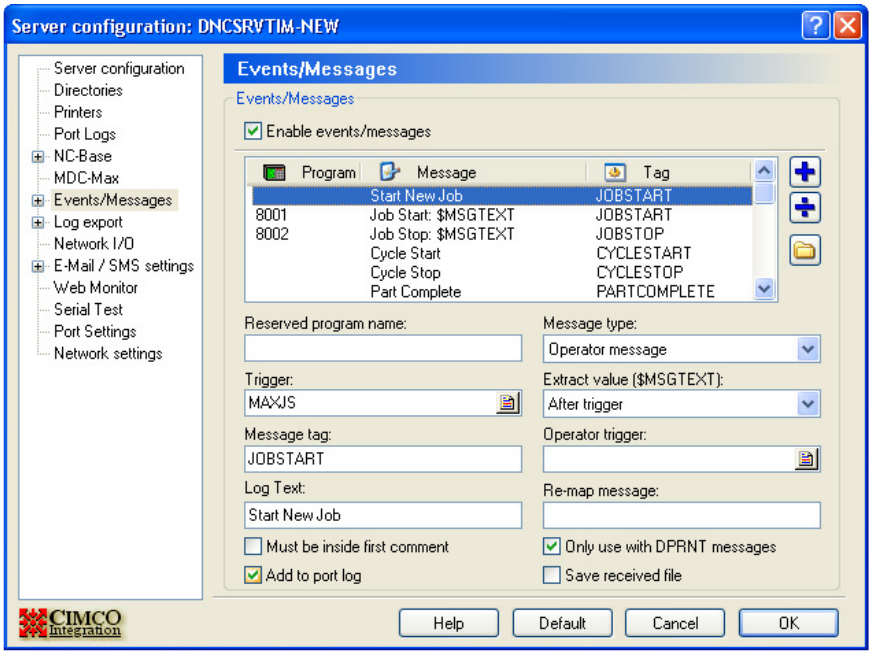
If you want to use a PC in a cell to generate these messages rather than a barcode reader see the section on Operator Screens later on.

1.5 More advanced Messages - Job Number

Because MDC-Max is integrated with DNC-Max it stores the date and time that a program is sent to a machine and we can use this as the current program in reports.

Sometimes it is useful (and more accurate) to store a separate job number whenever a job is started (on a manual machine that has no DNC for example). You can do this by creating a separate MDC barcode for every job that will run on the machine but you will soon end up with pages of barcodes. It is better to create a single barcode to mean “Start New Job” and then scan a separate barcode (on the customer’s paperwork) for the actual job.

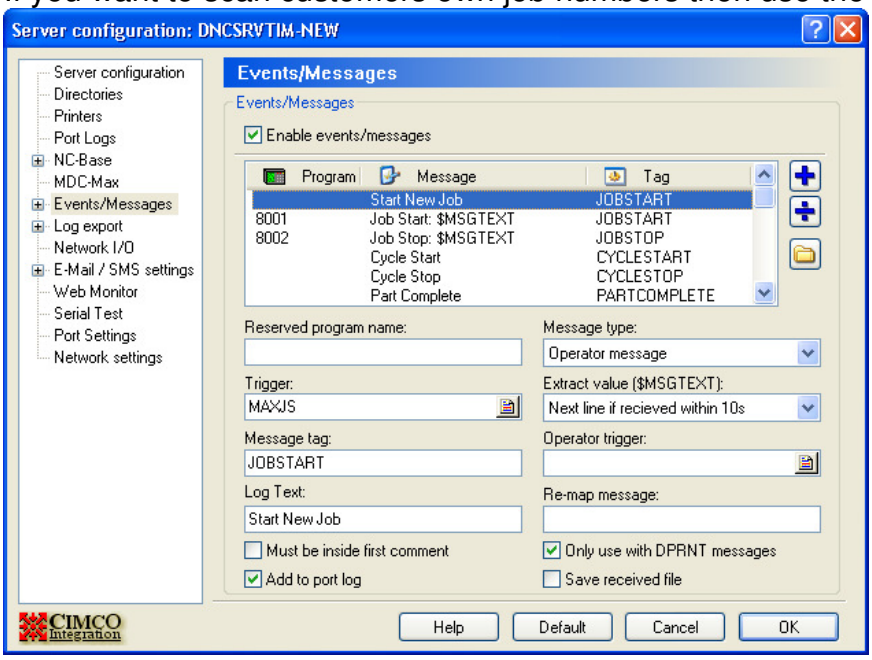
These messages are setup in the same way as before but with one addition - Extract Value Field.
Here is the setup when printing an individual barcode for each job:-



You would then need to print a single barcode for each job of the form MAXJS1234 where 1234 is the unique job number. The Trigger is MAXJS (the unique string scanned by the barcode reader), the Extract Value is set to “After Trigger” to make sure DNC-Max extracts the 1234 of the barcode after MAXJS. The message then generated is JOBSTART and DNC-Max will store anything after MAXJS (1234 in this case) in the MDC database as a separate field (Log Variable 1) which can then be used later on in reports.

So scanning MAXJS1234 will result in the JOBSTART message being generated and 1234 being stored with that message.

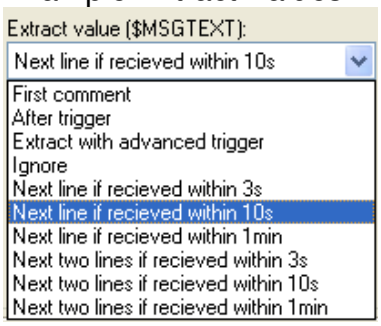
If you want to scan customers own job numbers then use the following setup:-



The operator scans the barcode MAXJS and then has 10 seconds (you can set this to 3 seconds as well) to scan the actual job number from another sheet. The only difference in setup is the Extract Value (Next Line if received within 10s).

Sometimes the customer will have paperwork where the jobname is made up from two barcodes. One is the Job or Part Number and the other is the Operation Number. In this case the operator would have to scan the MaxJS Start Job barcode then the Job Number then the Operation Number. MDC-Max can handle this by setting Extract Value to 'Next two lines if received within 10s'. MDC-Max appends the op number to job number and stores this in Log Variable 1. The individual Job number and Op Number are stored in Log Variables 2 and 3 respectively.

Example Extract Values.

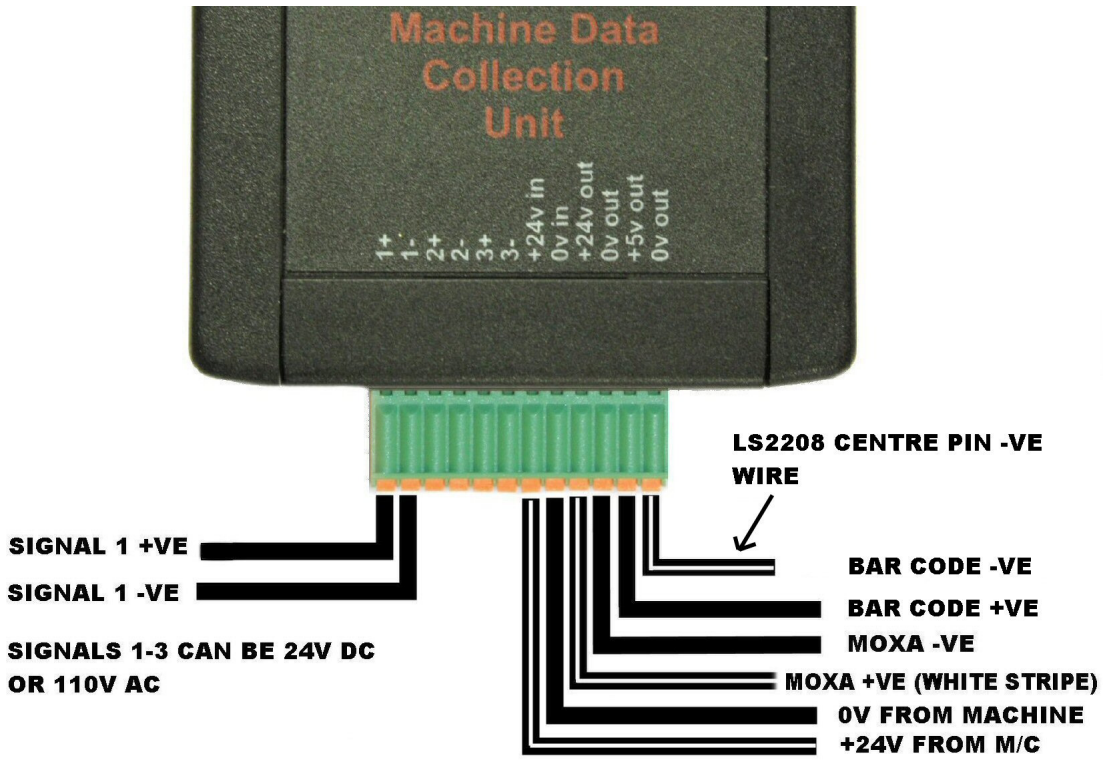


Chapter 2 – Using the MDC box to collect machine signals

The MDC box has three RS232 connectors at one end which are used to connect the RS232 cables and explained later.

At the other end of the MDC box is a green removable spring terminal block. The green terminal block has 12 connectors, which are labelled

1+	5-50V DC or 50-110v AC Input 1
1-	Common 0V Input 1
2+	5-50V DC or 50-110v AC Input 2
2-	Common 0V Input 2
3+	5-50v DC or 50-110v AC Input3
3-	Common 0V Input 3
+24v in	this should be connected to a 24v source in the machine control
0v in	this should be connected to a 0v source in the control
+24v Out	This is a fused output for Moxa W2150 / NPort 5110 / DE311 units
0v Out	This is a 0v common rail for the above
+5v out	this is an isolated 5v bar code reader power supply see note below
0v out	this is an isolated 0v bar code reader power supply see note below



The MDC box is designed to be powered from the machine's 24v DC power supply – no other voltage will do. Connect the +24v terminal to the machine's 24v supply and the 0v to the machine's 0v supply. The MDC box then provides a 24v DC supply out to power a Moxa type RS232 hub and a 5v DC supply out to power a barcode reader.

Note: All bar code readers provided by Cimco take power via a 1.3mm plug where the centre pin is negative (0v). Most other devices (including the Moxa

hubs) have centre pin positive so it is important to get the wiring right for the bar code reader otherwise you may damage it.

If you bought your MDC box from Cimco as a kit with an LS2208 barcode reader then the MDC box comes with the cables already connected to the green connector. Each pair of black wires has a white stripe on one wire and this is normally connected to the +ve terminal. The exception is the LS2208 bar code reader where the white stripe on the wire provided is connected to the centre pin on the power plug and therefore the other end is connected to the 0v terminal on the MDC box.

Wires can be inserted by pushing the orange release clips towards the green connector and inserting the wire fully so no copper is exposed. Release the orange clip and give the wire a pull to make sure it is secure.

2.1 Wiring the MDC boxes to the machine outputs

IMPORTANT NOTE : wiring into the machine signals should only be carried out by a competent machine electrical engineer – never attempt to make live connections with the machine powered on. If the machine is still under warranty and you have to modify any connections in the machine you will have to get the machine tool company's permission and confirm that it does not void the warranty. In these instances it is often easier to ask the machine tool company or an authorised engineer to fit the MDC box.

The MDC box can accept 5 to 50v DC signals or 110v AC signals and will convert these to an RS232 level output. In practise nearly all signals are 24v DC or 110v AC (older machines). You do not need to use relays for the 110v AC signals – just wire them directly into the box.

Make the connections to the green connector and then push the connector firmly into the MDC box before powering up the machine.

To monitor the machine's status the MDC boxes should be wired into the machine's output signals.

1+ and 1- are normally connected across the machines 24V running lamp
2+ and 2- are normally connected across either the machines M02 (Program End) lamp, or across any 24V signal that operates once a cycle and indicates the end of a cycle (part counter, parts catcher, Colet open, parts conveyer etc). Because these signals are not always available it is often necessary to wire into the machine in other places, or to use the third input (3+ and 3-) to get a third signal for additional information about the machine state.

Ideally you would get the relevant connector signals from the machine tool builder or the machine's electrical schematic. If this is not possible then examine the machine while it is running to see which lights go on or off at the start and end of the cycle.

If you cannot find a light then it is often necessary to look at the I/O modules in the machine cabinet while it is running to spot suitable signals.

As a last resort you may have to check signal levels when the machine is running live. Always use an Oscilloscope, NOT a multimeter for this purpose as a multimeter only has about a 1K resistance – an oscilloscope normally has one MegaOhm. USB based oscilloscopes are readily available for under 100 Euros for laptops. You may have to get a Certificate of Live Working to prove you are qualified to do this before you are allowed to run the machine like this. Make sure you follow all relevant Health & Safety procedures (these vary according to country).

In the case of most milling machines, and a lot of lathes the easiest place to monitor the machine is directly across the light on the 'Cycle Start' light for the cycle start signal, and across the M30/M02 lamp (this can involve soldering across pins on the switch panel circuit board) for the part complete. If a bar feed is being used then look for a part catcher or part conveyor signal (often

this is only accessible in the hydraulics panel of the machine) or a hardware parts counter. Other signals such as pallet positioning switches, chuck open signals, or bar feeder request signals have also been used. It is sometimes easier to use software monitoring (see separate section) to use a DPRNT statement at the end of each component.

It is often necessary to wire the monitoring boxes into the pilot lamps on top of the machine, these are normally a green, amber (sometimes blue) and red lamp in a wand or beacon on top of the machine. If these are fitted and their connections can easily be found in the control cabinet they are often the easiest way to monitor the machines state.

In some cases the lamp signals flash to indicate a paused state (waiting for operator) on the machine. This can be picked up in the DNC-Max settings to give an extra message (see Chapter 1 for setting up messages).

2.2 Wiring the RS232 Connectors to the MDC Box

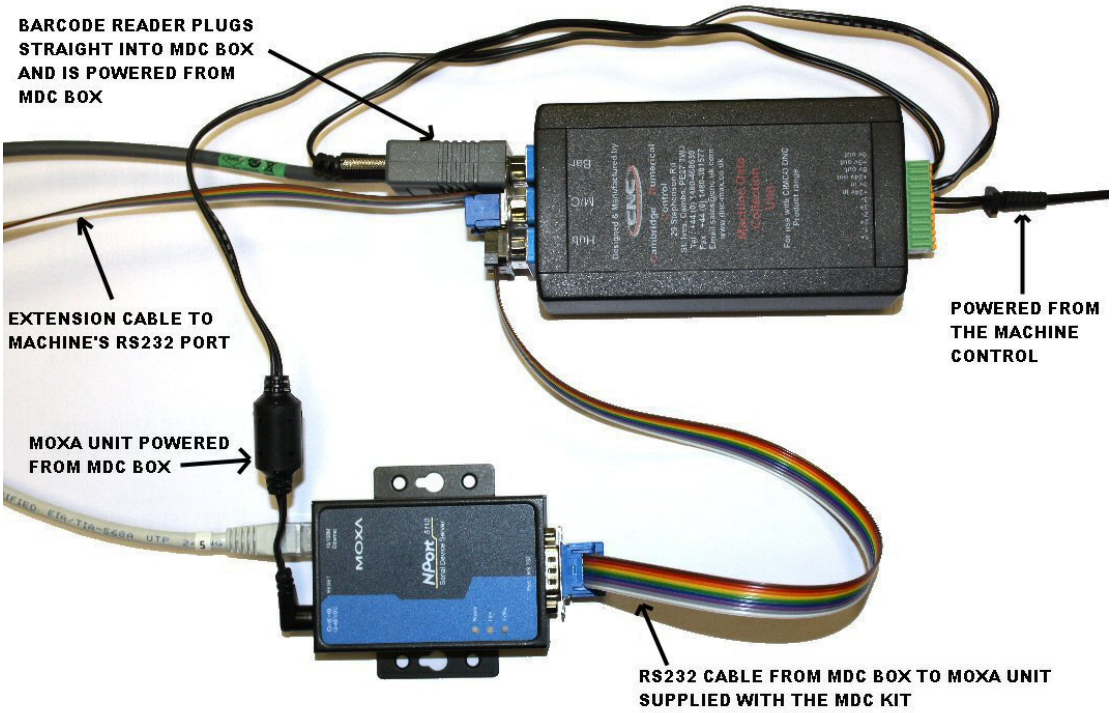
The RS-232 end of the 3 way box has three 9 way D-type connectors. These are labelled Hub, M/C and Bar.

The Hub connector is designed to plug into a Moxa 9 way serial port via a straight through 9 way cable which is supplied. This cable will also work for any other hubs that have a 9 way male serial port wired as a PC type interface (eg Quatech, Digi). Cimco have tested the following Moxa hubs; W2150+, NPort 5110 and DE-311.

If you are adding MDC to an existing DNC installation which is cabled to a remote multi-way hub (eg NPort 5610-16) or a PC with multi-way serial card (eg Moxa C168P) you will need to check that your existing cables have at least 7 wires in them and you will have to rewire both ends of the cable to carry the additional DCD and DSR signals. If in doubt contact Cimco before quoting as you may have to run all new cables.

The M/C connector is wired as a standard PC type serial port and should be used to connect to the machine via a standard 'Cross-over' or 'Laptop' cable unless you require 3 machine signals. If you require three signals you must link together RTS/CTS (normally pins 4 & 5) at the machine end of the cable and leave pins 7 and 8 disconnected at the MDC box end. This is because the third signal is passed back to DNC-Max via the CTS line on the Moxa hub and cannot be used for communications as well. Bear in mind that you will not be able to use hardware handshaking for that machine either.

The Bar connector is designed so that a 9 way RS-232 bar code reader can be plugged directly into it.

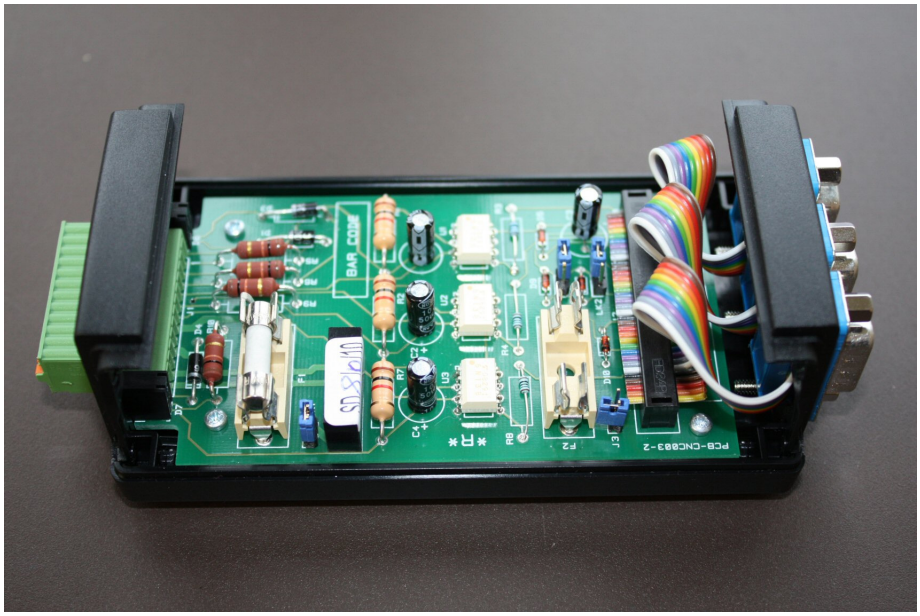


2.2.1 Configuring the internal MDC Box jumper settings

Depending on how you are going to use the MDC box you may have to change the internal jumper settings and fuse position. As standard the MDC box comes configured for 24v DC power input on the green connector and gives a 24v output for the Moxa unit and a 5v output for the barcode reader. If you are not going to use a barcode reader or you want to use a 24v source from a Fanuc RS232 connector YOU MUST open the box and change the settings.

Opening the MDC Box

To adjust the links on a MDC unit the top of the box has to be removed. At the ends of the box near each corner there is a small rectangular hole. Insert a small screwdriver into each hole in turn while gently easing the box apart. The box should then come apart revealing the circuit board inside as below.



MDC Unit Configuration.

There are three links (LK1, LK2 and LK3), two fuse positions (F1 and F2) and a jumper (J3) on the MDC circuit boards (Check the Part number is PCB-CNC003-2). These links are used to control how the unit routes RS232 data, 24v power in and out and 5v power out for a barcode reader.

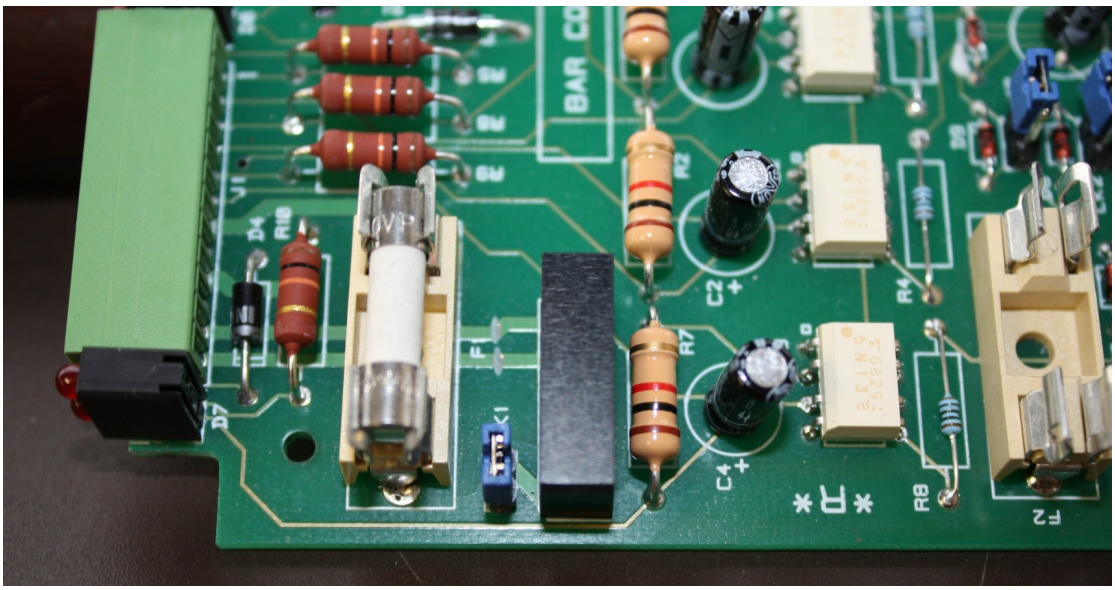
If the MDC unit is being used with a Moxa serial hub that is powered from the machine (using a Moxa PSU plugged into 110-24v socket) and there is no requirement for a barcode reader, then there is no need to connect 24v to the MDC box (+24v and 0v in connections).

If the MDC unit has to supply power to a barcode reader (+5v out) or a Moxa unit (+24v out) it will require a 24v supply connected from the machine.

This 24v input supply can be connected to the +24v in and 0v in sockets on the green connector, or in the case of most Fanuc controls from pin 25 on the machine's RS232 connector. Using pin 25 on the Fanuc control can cause occasional problems with some Fanuc based controls, in which case using the machines 24v supply is the better option.

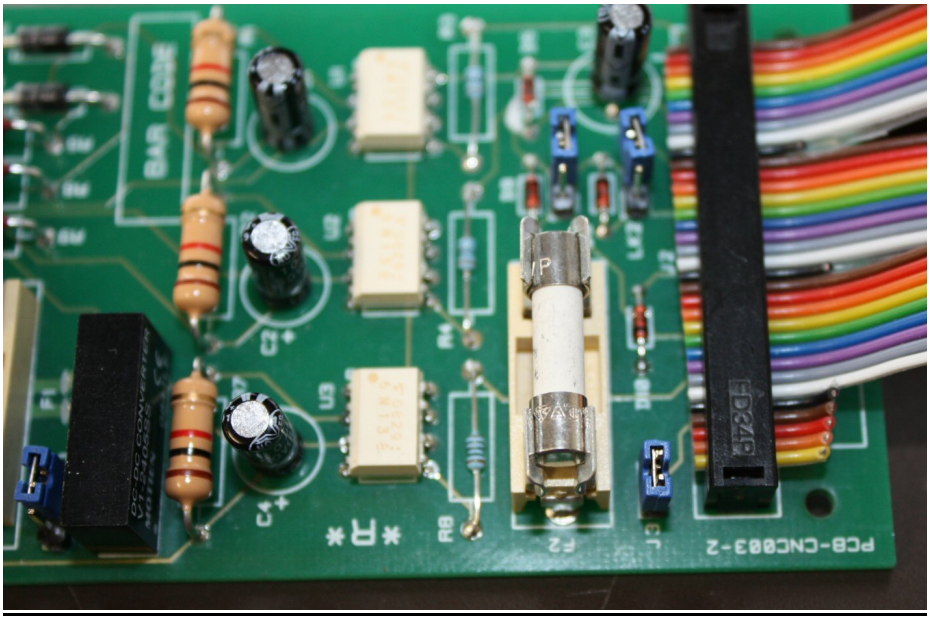
Powering the MDC unit from the machines 24v supply (into the Green connector)

We supply the MDC unit configured for 24v supply on the green connector and 5v output for a barcode reader. This is done as follows. The 1Amp fuse is placed in F1 to use power from the green connector as the pictures below.



If the MDC unit is being used to power a barcode reader make sure link LK1 is in place, this sends the 24v input into the 5v converter (the black component beside the link) used to power the barcode reader. If the MDC unit is not being used to provide power for the bar-code reader LK1 MUST be removed to prevent damage to the 5v converter.

Powering the MDC box from the Fanuc RS232 connector



If you want to power the MDC box from the Fanuc RS232 connector you need to make up a special RS232 cable as below. This cable takes the 24v from the Fanuc pin 25 and supplies 24v to pin 9 on the M/C connection on the MDC box. The fuse has to be moved to fuse holder F2 and the link J3 should be closed as the picture above. Again if the MDC box is being used to power a bar code reader make sure link LK1 is in place (see section above), this controls the 24v input into the DC/DC converter used to provide 5v for the bar code reader. If the MDC unit is not being used to provide power for the bar-code reader LK1 MUST be disconnected to prevent damage to the 5v converter.

Cable Spec, for powering the MDC unit from a Fanuc 25 way rs232 connector

9 way M/C connector on MDC box 25 Way Fanuc on Machine

(9 way female)		**(25 way male)**
3 ----------	brown----------	3
2 ----------	red----------	2
7 ----------	blue----------	5
8 ----------	white----------	4
5 ----------	black----------	7
1 ----------	Yellow----------	1
9 ----------	Orange----------	25
		6,8,20 Linked

Diode By-pass links for long cable runs

The MDC unit is designed to connect to a serial hub (wired or wireless) inside the control cabinet of a machine tool (eg Moxa W2150+), by a short ribbon cable. In some instances this is not possible, either the serial hub is not mounted in the machine cabinet, or the machine is cabled to a remote hub that serves multiple machines. The RS232 signals inside the MDC units have signal diodes in them to avoid RS232 conflicts between the bar-code reader and machine tool interfaces.

In some cases, if the serial hub is some distance from the machine, this can cause problems with signal strength on the RS232 signal line out of the MDC unit back to the serial hub.

You will notice that the RS232 data from the machine is corrupt. In most cases closing Link LK2 resolves the problem with the machine RS232 signal, in very rare cases this also affects the bar code reader signal, in which case LK3 should be closed as well.

This corruption can also be caused by poor machine control earthing and the installer may need to consider opto-isolation between the MDC unit and the machine control.

2.2.2 “Standard” wiring from the MDC box to the machine

A “standard” machine (ie Fanuc, Heidenhain etc.) will use one of the following cable specs :-

Cable from MDC Box to MC (machine requires RTS/CTS handshake)

MDC box (9 way female)		MACHINE (25 way male)
3	brown	3
2	red	2
7	blue	5
8	white	4
5	black	7

6,8,20 Linked on machine end

Cable from MDC Box to MC (machine uses XOn XOff handshake)

MDC box (9 way female)		MACHINE (25 way male)
3	brown	3
2	red	2
5	black	7

4-5 linked on machine end
6,8,20 linked on machine end

Cable from MDC Box to MC (machine uses XOn XOff handshake)
MDC box powered by the Fanuc RS232 24V supply on pin 25

MDC (9 way female)		MACHINE (25 way male)
3	brown	3
2	red	2
5	black	7
9	black	25

4-5 linked on machine end
6,8,20 linked on machine end

Note this assumes a Fanuc control with a working 24v supply on pin 25 of its serial port. To use this option it is necessary to open the MDC box and move the input fuse and connect a link. Contact CNC for details. The maximum current you can draw from the RS232 line is limited so you can only power the MDC box, a single Moxa port and a bar code reader from this source.

2.2.3 CE Approval for MDC Box

The MDC box now has CE Approval and this applies to all circuit boards bearing the PCB-CNC003-2 marking. There is a new self-adhesive label which can be fixed to all existing boxes bearing that part number. Please contact Cimco for details.

The CE Approval certificate is enclosed :

Barclay-Phelps

CE Marking Consultants

Barclay Phelps CE Marking Consultants, 196 High Road, London, N22 8HH, United Kingdom

CERTIFICATE & DECLARATION OF CONFORMITY FOR CE MARKING

Company contact details:
Cambridge Numerical Control
Unit 8 Royce Court, St Ives, Cambridge, PE27 3NE, United Kingdom
Tel: 01480 468639 Fax: 01480 301577 sales@cnc.uk.com www.cnc.uk.com

Cambridge Numerical Control declares that their:
Machine Data Collection Unit
Model CNC-MDC003A

is classified within the following EU Directives:
Low Voltage Directive 2006/95/EC
Electromagnetic Compatibility Directive 2004/108/EC

and further conforms with the following EU Harmonized Standards:
EN 60950-1:2006+A12:2011
EN 55022:2010
EN 55024:2010

Dated: 28 September 2011
Position of signatory: Partner
Name of Signatory: Tim Collett
Signed below:
p.p. Cambridge Numerical Control

2.3 Testing the Machine Outputs

Once you have found the machine outputs and wired them into the MDC box connector you can check them in two ways, by checking the LEDs on the box and by checking that the messages are being received by DNC-Max.

On the green connector end of the MDC Box there are 4 LED's. The Top right LED indicates that the box has power, this should always be on.

Top Left – Signal 1
Bottom Left – Signal 2
Bottom Right – Signal 3

These LED's will light each time a signal is active.

For example the In-Cycle Signal (normally signal 1) should be on all the time the machine is in cycle and the Part Complete Signal (signal 2) should flash once when a part is completed.

As long as you have configured the messages for each machine in the DNC-Max Server (see Section 1.2) and configured the message in the machine Port configuration (section 2.6) you should see the relevant message appear in the machine port log.

Open the DNC-Max client, select the machine and click the Log Tab and run the machine. You should see a CYCLESTART message every time the machine starts and a CYCLESTOP message each time the machine stops. You should also see a PARTCOMPLETE message when the job completes (assuming you setup that message).

If you can see the LEDs light on the MDC box but cannot see the messages in the machine log you need to investigate further. Click the Debug tab in the DNC-Max client and click Start Log to start a debug log then run the machine.

Each time the machine starts and stops you should see a change in the DSR status in the debug log. If you do not and you have a Moxa unit installed in the machine then you have a hardware fault (MDC box or Moxa hub). If you are using a multi-way hub wired to several machines (NPort 5610 etc.) it may well be a cable problem.

If you can see the DSR status change in the debug log and you are not seeing the CYCLESTART and CYCLESTOP messages in the Port log then your configuration is incorrect. See section 2.6 and check the minimum cycle time – you may need to increase this. Each DSR status change is timestamped in the debug log so you can work out the time taken to change states.

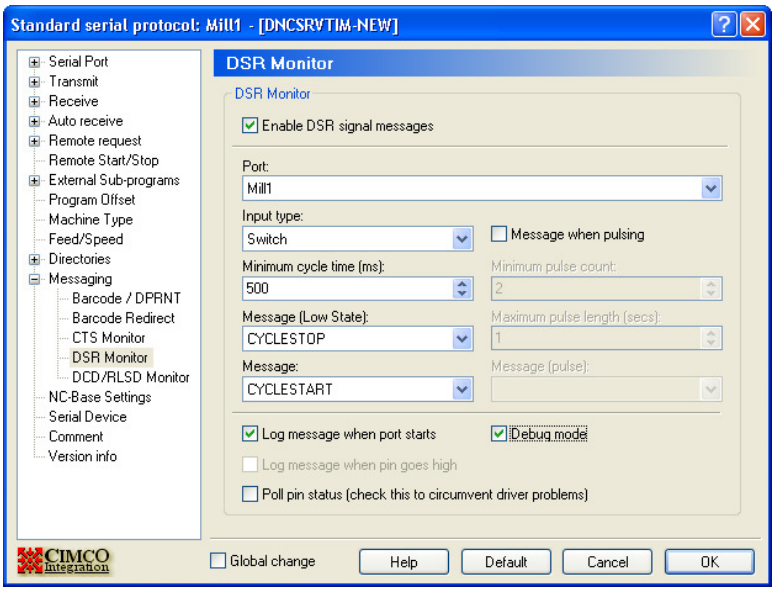
NOTE : if the machine is running a program continuously (eg bar fed lathe) you will not see a CYCLESTOP message until you physically stop the machine. You should see a single CYCLESTART followed by a PARTCOMPLETE each time the program repeats itself.

2.4 Configuring the hardware monitoring signals in DNCMax

Once the monitoring boxes are wired into the machine's electrical system and the indicator LEDs on the MDC box light up as required the next thing to do is to configure the DNC-Max serial protocol to respond to the signals.

Assuming that signal 1 on the MDC box is connected to the Cycle Start signal on the machine and Signal 2 is connected to the M30/M02 lamp, part catcher or cycle counter on the machine.

Open DNC-Max client, highlight the relevant machine and open the port settings (Port Configure Port) then click the + sign next to Messaging.



2.5 MDC Box Signal 1 (In Cycle)

The first signal on the MDC box is sent back to DNC-Max via the DSR line on the serial port and this is normally wired as In-Cycle. Click the DSR Monitor and tick Enable DSR signal. Set the input type to Switch (either on or off), the Message low state to CYCLESTOP and the Message (below) to CYCLESTART. Tick the Log Message when port starts box, this makes sure that the current state of the signal is sent when the machine port starts.

This setup will generate two messages, CYCLESTART when the machine is running and CYCLESTOP when the machine is not. It works like this :-

- The machine goes into cycle and generates a +ve signal on Pin 1+ on the MDC box input.
- The MDC box converts this to a +ve signal on the DSR line.
- DNC-Max detects this change in signal on the serial port and generates a CYCLESTART message.
- The machine stops and the +ve signal on the pin 1+ on the MDC box drops back to 0v.
- The MDC box drops the +ve signal on the DSR line.

- DNC-Max detects that the line has gone low and generates a CYCLESTOP message.

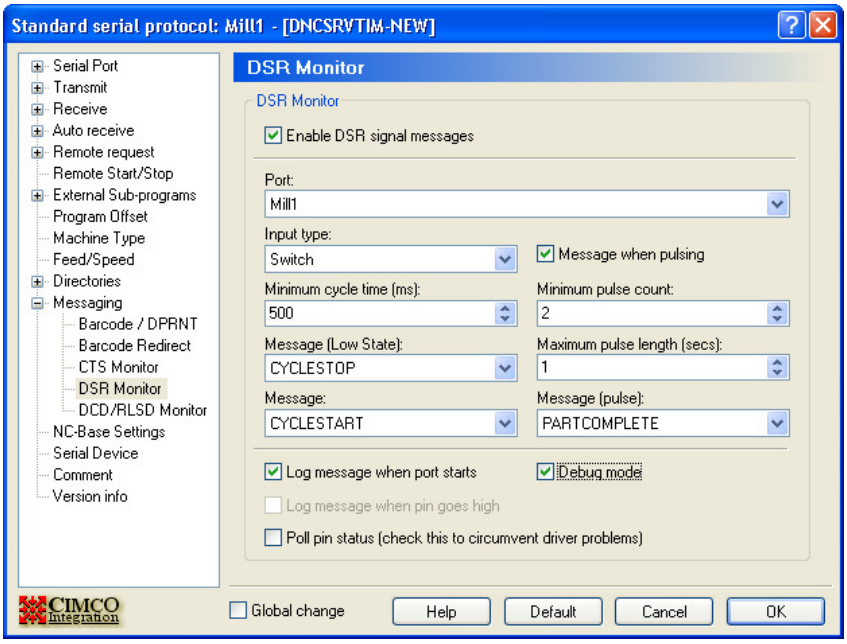
The minimum cycle time is the time taken for the machine to change state – leave this set to 500mS in most cases. This will filter out any electrical noise when the machine changes state.

Ticking the Debug Mode will force all messages to appear in the port log regardless of the setting in the DNC-Max server configuration. Once the system is working properly turn this off to avoid filling the port log.

2.6 Pulsing Signal on Haas Machines

Some machines (notably the Haas) will flash the in-cycle lamp when the part has completed. We can use this fact to generate a PARTCOMPLETE message on the same signal as the in-cycle signal.

Tick the “Message when Pulsing” box, set the minimum pulse count to 2 (to prevent a single flash from triggering a message) and the maximum pulse length to 1 second. Set the Message to PARTCOMPLETE.



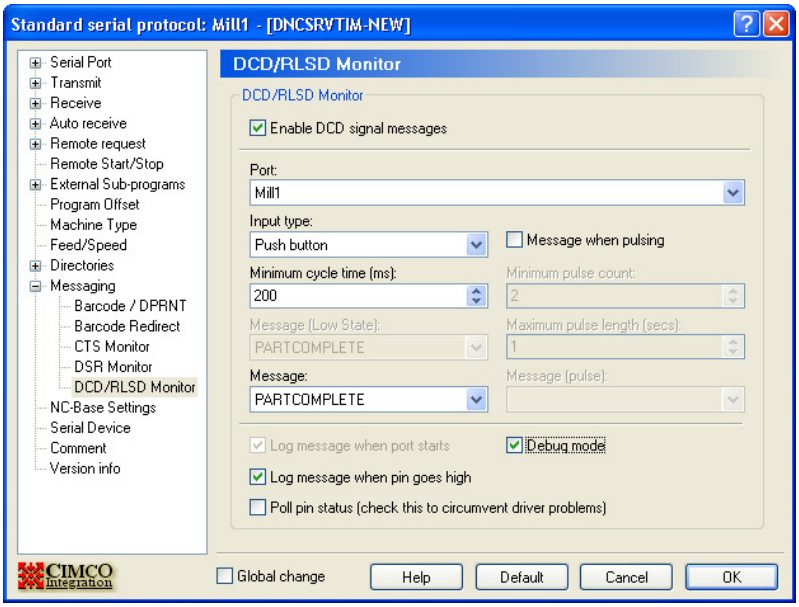
If the light is flashing once a second you will need to increase the Minimum Cycle Time from 500mS to more than 1 second otherwise you will generate continuous CYCLESTART / CYCLESTOP messages.

Note that on some machines (eg DMU) a flashing in-cycle lamp means waiting for operator and you can use this to generate a different message (eg WAITINGOPER).

2.7 MDC Box Signal 2 (Part Complete)

The second signal on the MDC box is sent back to DNC-Max via the DCD line on the serial port and is normally used for Part Complete (unless you have a pulsing in-cycle lamp as above).

Click the DCD Monitor and tick Enable DCD signal. Set the Input Type to Push Button (signal Comes on for a short while then goes off) and the minimum cycle time in mS (the signal may come on for several seconds or it may just flash very quickly). Click the “Log message when Pin goes High” and set the Message to PARTCOMPLETE. You can also use a low signal state to generate a message (useful if the machine signal is always high except when a part is completed).



2.8 MDC Box Signal 3 (Alarm, Doors Open etc.)

The CTS Monitor can be used to collect a third machine signal as required but only if the machine does not require hardware handshaking for the communications (Flow Control must be set to Software in the Serial Port section of DNC-Max) . Most machine controls (Fanuc, Haas, Heidenhain) do not require this so can generate a third signal.

Click the CTS Monitor and tick Enable CTS signal messages. Setup the Input type in the same way as above and set the message to the one required (such as ALARM).

Make sure that you run a 3 wire cable from the MDC box to the machine and link out RTS/CTS (usually pins 4 & 5) on the machine end of the cable (along with any others needed for the control such as 6,8,20).

Chapter 3 – Barcode Reader Installation on machines

3.1 Choosing the barcode reader

If you are buying your own barcode readers for use on each machine then make sure that they have an RS232 interface (often sold as an add-on module) that plugs into a standard PC 9 way serial port and that they require a 5v power supply (most do). Cimco recommend the Symbol LS2208 RS232 barcode reader and this can be bought complete with the RS232 module and mounting stand as a kit from Cimco if required.

3.2 Mounting the Barcode reader

The main consideration when mounting a bar code reader on a CNC machine tool is how the operator will have access to it. There is no point placing a barcode reader on the back of a machine tool if the operator has to leave the control to use it. In most cases the reader should be attached to the side or top of the control panel, near a flat surface to which a barcode chart can be attached.

Drill a hole in the machine cabinet big enough for the barcode reader end of the cable to pass through (it comes away from the barcode reader) and put a rubber grommet in the hole. The RS232 end of the cable plugs directly into the MDC box. Then feed the cable through the grommet and reconnect to the barcode reader. In some cases it will be necessary to extend the RS232 lead supplied with the bar code reader which should be done inside the machine cabinet. The flexible stand can then be fixed to the machine by screws or Velcro.

3.3 Configuring the baud rate on the bar code readers

Once you have setup the machine baud rate you must set the baud rate and stop bits on the bar code reader to match that of the machine. You can either do this on each machine one at a time where the barcode reader is powered from the MDC box or you can pre-program all the barcode readers before installation using an external power supply (Cimco supply one with the barcode reader for this purpose).

Setup is achieved by powering up the barcode reader and scanning a series of special purpose barcodes from the user manual.

You will need to print the relevant barcode pages from the barcode manual (you can laminate them for later use) in order to scan the baud rate settings. The Cimco dealer pack includes laminated copies of the relevant sections of the LS2208 user manual.

If you are using the Cimco LS2208 barcode reader print the following pages from the user manual and then scan the options as below :-

6-7	Host Type – scan Standard RS-232
6-9 & 6-10	Baud rate – scan the correct baud rate
6-11 & 6-12	Parity – scan parity code (normally Even)
6-13	Stop Bits / Data Bits

Adding a CRLF to the end of the scan

Most barcode readers do not send an end of line (CRLF) by default after the scan. DNC-Max expects this at the end of a string so you will need to print the relevant pages from your manual to do this.

If you are using the Symbol LS2208 barcode scanner then you will need to print the following pages :-

13-6 to 13-8 Scan “SCAN OPTIONS”, then”<DATA> <SUFFIX>” then “ENTER”

Once the barcode readers are setup the settings are kept in flash RAM so you can remove power from them and install them in the machines without losing the settings.

See “Appenix A – LS2208 Setup” for a two page document which can be printed with all the scan codes needed for the LS2208 barcode readers.

3.4 Testing the Barcode Readers

Once programmed connect the bar code reader into the MDC box in the machine. On the DNC-Max client, highlight that machine and click the Terminal tab, then on the machine try scanning some bar codes. Use the sample barcodes from the dealer kit or scan a code from the barcode manual. Scan a code and check that you are seeing the appropriate code (eg MAX8010) followed by newline (CRLF) on the DNC-Max terminal screen.

Chapter 4 – Printing your own bar codes

4.1 Installing Bar Code Fonts on a Windows PC

You will need access to a PC with Microsoft Word and a printer to print bar codes for MDC-Max. This can be your own laptop or one of the customer's PCs (The customer will probably want to re-print the barcode sheets so let them have the install).

Run INSTALL.EXE file from the Bar Code Font Install folder on the MDC-Max dealer CD (You can also download it from www.idautomation.com/fonts/free). This installs a font into Windows that can be used in Microsoft Word (and other Windows applications) to create Code 39 Barcodes (also known in the US as "USD-3" and "3 of 9").

If the customer wants to scan their own paperwork it does not matter that their barcode is a different type as the bar code readers will read many different bar codes and still send the correct characters back to MDC-Max. As long as you can read their barcodes correctly you can still print your own MDC-Max barcodes in Code 39.

Code 39 includes the digits 0-9, the letters A-Z (upper case only), and seven special characters (-.*$/+% and space). Each Code 39 barcode MUST begin and end with an asterisk (*) in addition to the characters required – eg *MAX8021*

4.2 Printing Barcode sheets for MDC-Max

Once the messages have been set up in DNC-Max (see Section 1.5) the barcodes have to be printed for each downtime reason onto a single sheet that can be laminated and stuck or mounted on the machine.

Please follow these rules when printing barcodes:-

- The total width of the printed barcode should not exceed the width of the bar code scanner head (obvious really).
- Use a good quality laser or inkjet printer, blurred or poor quality barcodes will cause errors.
- Keep the font size large to get the best results.
- Leave plenty of space between barcodes so there is no chance of scanning the wrong code.
- Laminate the finished sheet using matt laminating pouches – not gloss which is too shiny.

Start a new MS Word File, type the description for the operator in a large ARIAL font (16 point is OK), then press enter for a newline. From the Font box on the tool bar select the IDAutomationHC39 font and then type the DNC-Max code for that message.

For example if ‘MAX8021’ is the trigger set in DNC-Max as SETTING downtime reason , type SETTING in the Arial font, press enter for a new line, then change font to IDAutomationHC39 and type *MAX8021* (don’t forget the * at the beginning and end).

SETTING

MAX8021

Please note that the second line above will only display as a barcode if you have the bar code font installed.

The barcode font produces the barcode and the text for the DNC-Max message. This makes it easy to check that you have printed the correct codes and edit them if necessary.

You can put several barcodes on a line together provided they are far enough apart :-

DOWNTIME REASON CODES – XYZ Engineering

NO RESOURCE

MAX8020

SETTING

MAX8021

1ST OFF INSPECTION

MAX8022

TOOLING ISSUE

MAX8023

MAINTENANCE

MAX8024

SCRAP PART

MAX8025

CUST APPROVAL

MAX8026

MATERIAL ISSUE

MAX8027

TRAINING

MAX8028

4.3 Barcodes for Job Names

If the customer wants to use barcodes to indicate the start of a new job (for example for manual machines) a job number barcode is required. To do this you can print a single barcode with a start job code followed by the actual job number or use two separate bar codes, one to mean start job and the other one could be on the customer's own paperwork (the customer's paperwork does not have to use the same type of bar code).

Setup the MAXJS message in DNC-Max (see Section 1.6) for individual jobs and print a single barcode for each job needed as follows :-

JOB START 123456

Where 123456 is the job number.
This is only useful if the customer is running a small number of specific jobs on a machine (manual presses for example).

In general it is more useful to print a separate bar code that means job start and then scan the customer's own paperwork for the actual jobnumber.

Setup the MAXJS message in DNC-Max (see Section 1.6) which waits for a second scan and print a single job start barcode :-

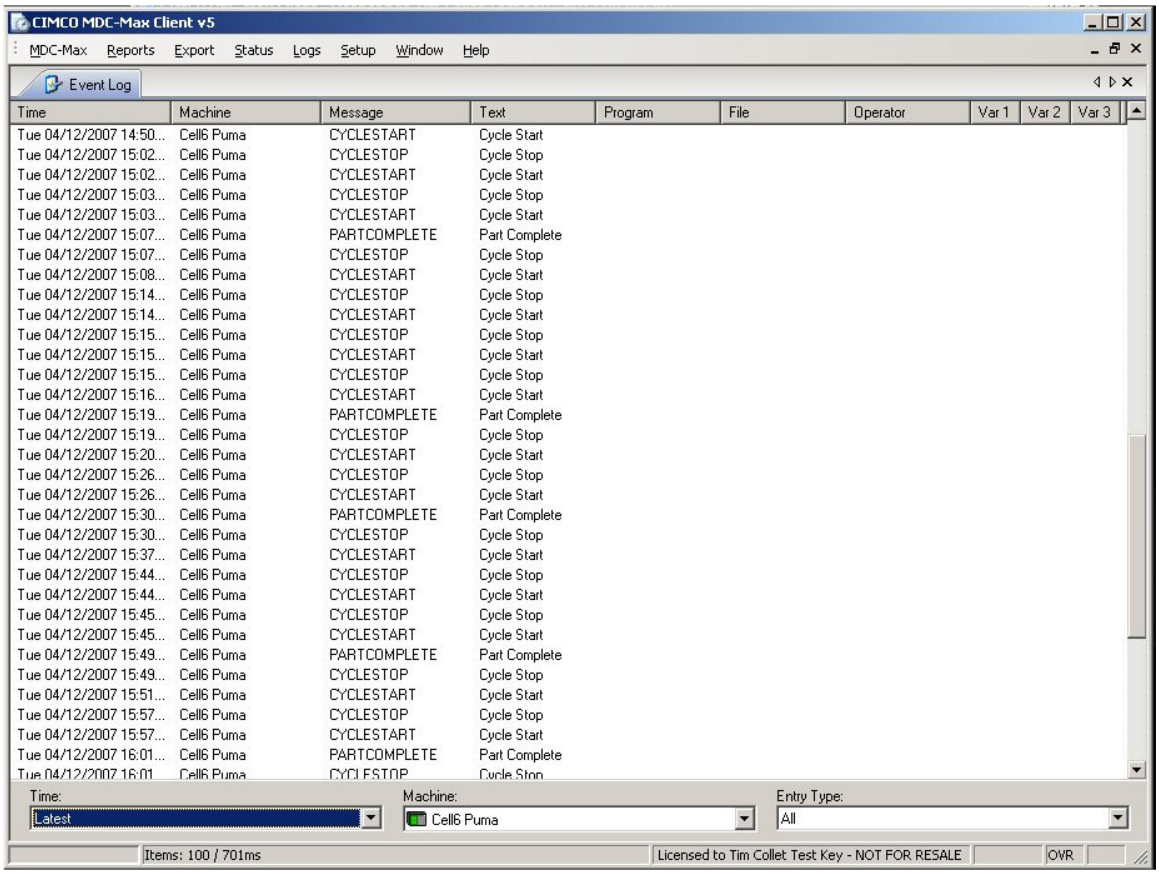
JOB START – (Scan this then scan Job No.)

This will send the JOBSTART message and, as long as the operator scans the relevant paperwork within 10 seconds the jobnumber is extracted from the second scan.

See "Apendix B – Example Barcodes" for an example bar code sheet.

Chapter 5 – Configuring MDC-Max

Once you have installed the MDC hardware box or DPRNT messages and configured the messages in DNC-MAX, you can check that the MDC-Max Event Log is logging the messages correctly. Open MDC-Max Client (different to the DNC-Max client) and click Logs, Event Log and the screen should look similar to the one below:-



You can use the Machine drop down box at the bottom of the screen to filter by machine.

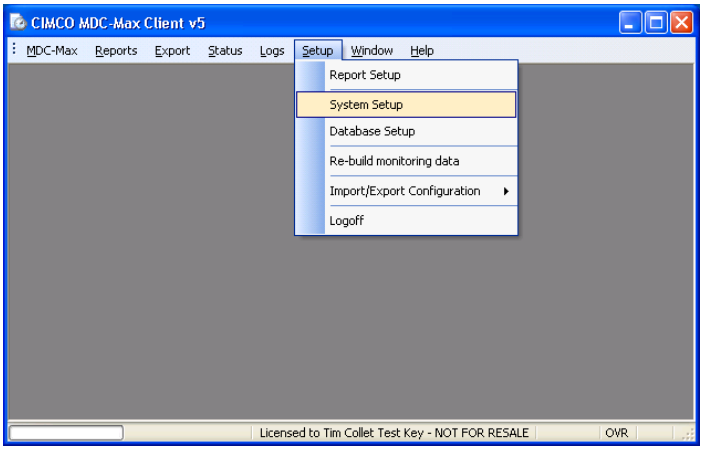
If you do not see these messages in MDC-Max you need to check the port logs in DNC-Max to diagnose the problem (see section 2.4).

5.1 Adding Timers

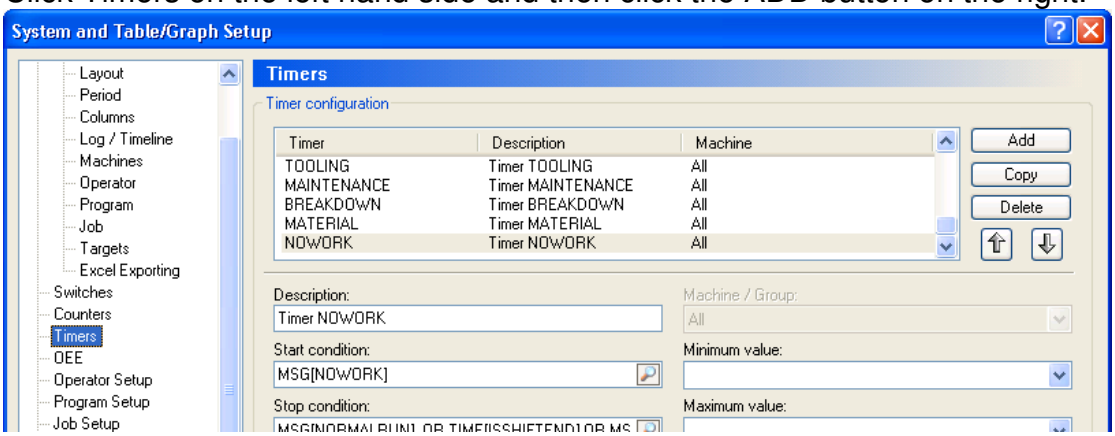
MDC-Max uses timers to count the time from the start of one event to another and it is these timers that generate the information that we use on the live screens and in reports. Our first timer will be called CYCLE and will be used to calculate the time from each CYCLESTART message to the following CYCLESTOP message.

Warning :- this setup will only work if the machine does not stop in the middle of a program (eg for a probe cycle).

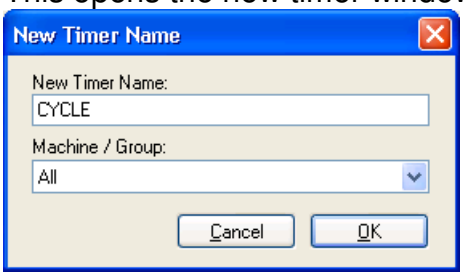
This can be done as follows :-
Click Setup in MDC-Max then System Setup.



Click Timers on the left hand side and then click the ADD button on the right.

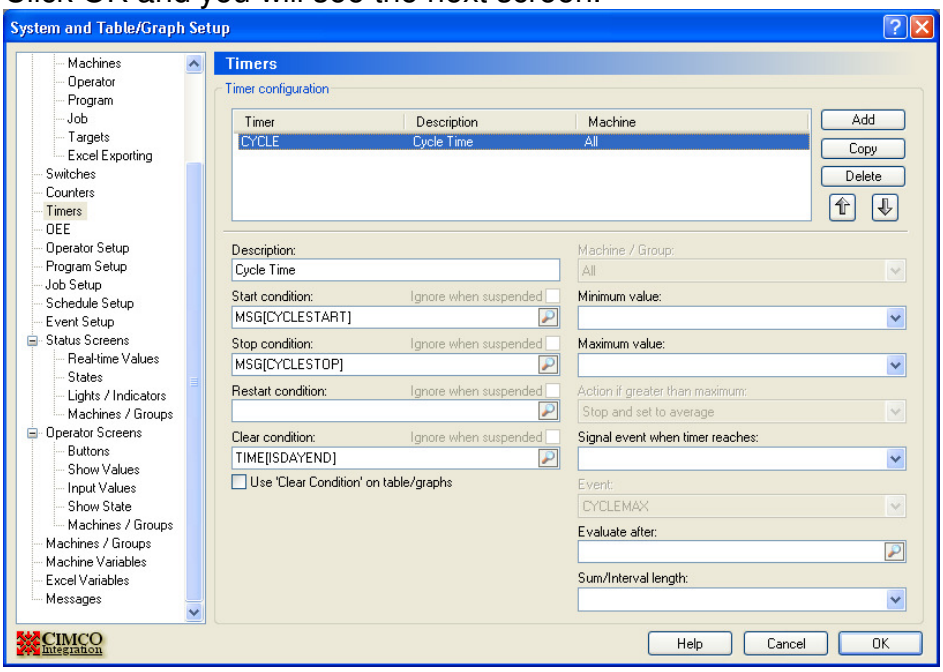


This opens the new timer window – enter CYCLE for the new timer name.



You can select an individual machine or group but for now we leave this set to All. MDC-Max will then create a CYCLE timer for every machine automatically which is what we want as the cycle times on each machine will be different.

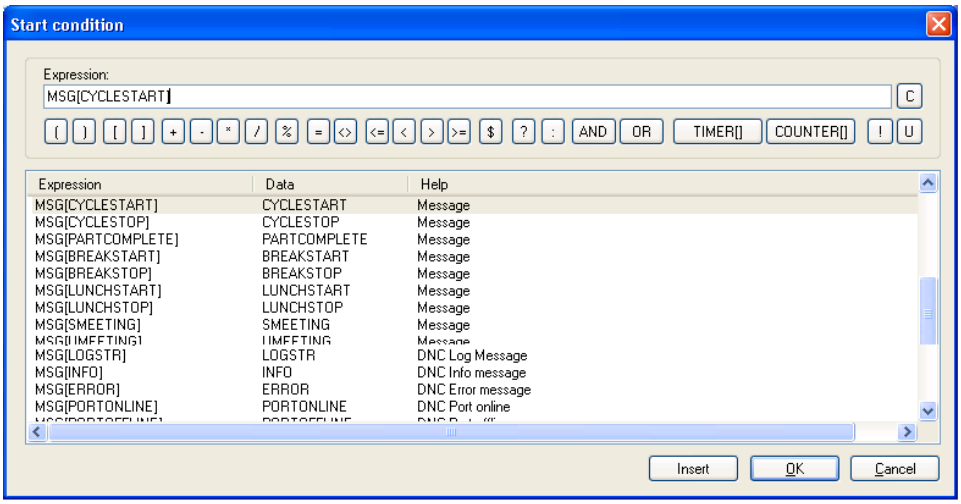
Click OK and you will see the next screen.



Click into description and set this to Cycle Time – this is just a comment. Next we have to describe the start and stop conditions for this timer. We will be using the messages generated by DNC-Max to start and stop the timers.

5.2 Setting Timer Start and Stop Conditions

Click the search icon (magnifying glass) to the right of start condition and another box will appear.



We want the timer to start when we get the message CYCLESTART from the machine. In MDC-Max all messages are denoted by MSG[nameofmessage]. Scroll down the list to the section that starts with MSG. Click on the MSG[CYCLESTART] (remember we setup the CYCLESTART message in section 1.2) and click the Insert button below so it appears in the Expression box, then click OK to be returned back to the timer screen.

Click the search icon to the right of the Stop Condition to open the Expression window again and find the MSG[CYCLESTOP] message. Click Insert and OK. This means the timer will stop when we get a CYCLESTOP message from the machine.

The restart condition is used to start a new cycle time even if the stop condition has not been reached. Leave this blank for now.

5.3 Setting Timer Clear Condition

When you are running a live screen you only want to see cycle times and accumulative totals from today – this is where the Clear Condition comes into play. Click into the Clear Condition, click the search icon and scroll to the bottom of the Expressions where you will find TIME. Select TIME[ISDAYEND] and OK.

TIME[ISDAYEND] is a binary condition - it is either TRUE (the current time is the end of the day) or FALSE (the current time is not the end of the day).

Setting the clear condition to TIME[ISDAYEND] means that the current timer (CYCLE in this case) will be reset to 0 at the end of the day.
Note, however that the clear condition only clears the accumulated cycle timer for the live screen. If you tick the box below it will also clear all daily and weekly timers used for historical charts (don't do this unless advised by Cimco).

Click OK and the CYCLE timer is created and will start when the operator presses cycle start and stop when we get a part complete message. This timer setup is used for manually loaded machines.

Once a timer is created is generates several internal timer values.
This timer serves several purposes as follows:-

- It times the current cycle and this can be reproduced on a livescreen by using the variable TIMERLAST[CYCLE]
- It stores the previous cycle time and this can be reproduced on a livescreen by using the variable TIMERPREV[CYCLE]
- It accumulates the total cycle time for a given period and this can be reproduced on a livescreen by using TIMER[CYCLE]. If you set the Clear Condition as above then the livescreen accumulated time will reset to 0 at the end of the day.
- It accumulates the total cycle time for charts and graphs which can have a longer period (eg a week or a month)
- It stores the Minimum, maximum and average cycle time for a given period which can be re-produced by the variables TIMERMIN[CYCLE], TIMERMAX[CYCLE] and TIMERAVG[CYCLE] on both livescreens and reports.
- It Stores the Count for a given timer period which can be reproduced by the variable TIMERCNT[CYCLE]. This is the number of cycles (parts) in this case.

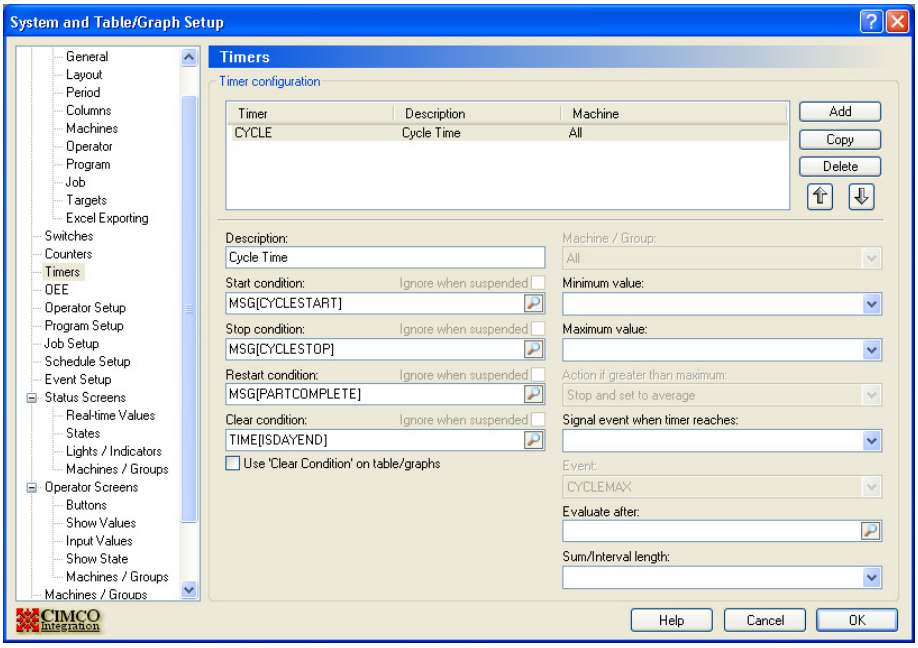
There are also other uses but the above are the most frequently used.

5.4 Setting Timer Restart Condition (automatic or bar fed machines)

A bar fed machine will start a cycle and then continue in-cycle until the bar feed runs out or there is an error so we only ever get one CYCLESTART message for every batch of components. However we do get a PARTCOMPLETE message for each component (as long as you have set this up).

The Restart condition will stop the current timer, save the timer values and timer count and then start a new timer cycle.

The setup for a bar fed or automatic machine should be as below:-



The start and stop conditions are the same, click into the Restart Condition box and set it to MSG[PARTCOMPLETE]. This way we can still store individual cycle times.

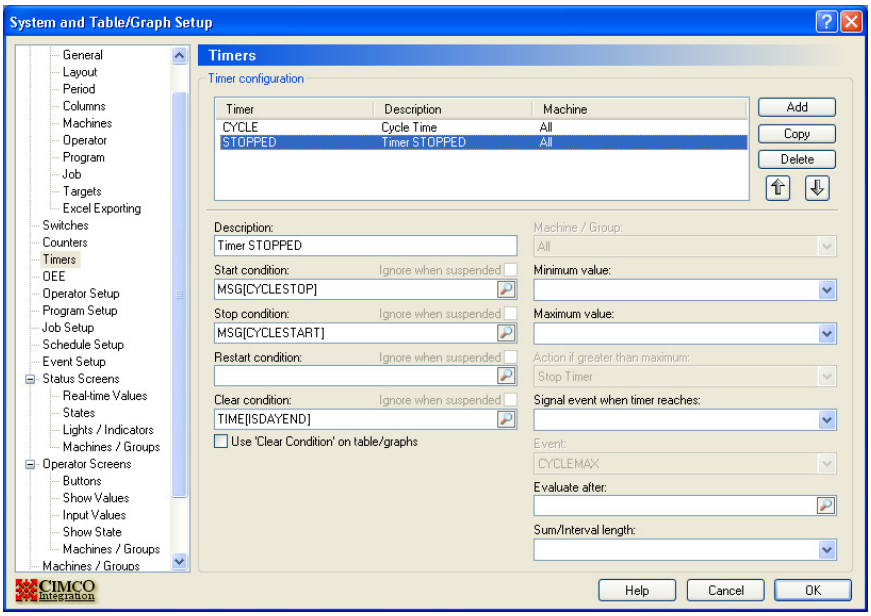
It is worth pointing out here that each on the 4 conditions on the left are either TRUE or FALSE. For example the machine either sends a CYCLESTART message or it does not.
The start and stop conditions are obvious, the Clear condition needs some explaining.

MDC-Max has built in functions that you can use to determine the current time, when a day starts and ends and other time related values. We want to clear our timer at the end of the day for the livescreen so we use the built in function TIME[ISDAYEND] – this is True when we get to the end of the day (see Schedule later on to determine the start / end of a day or shift).

5.5 Stopped Timer

Next we setup a Stopped timer to keep a record of the total downtime for each machine.

Click Setup System Setup, highlight the Timers section and then add a new timer as follows :-



The start and stop conditions are the reverse of the CYCLE timer. The timer starts when the machine is stopped and the ends when the machine starts. If you are not planning to use barcodes or a PC to enter downtime reason codes you can skip the next section and go straight to the Schedule setup.

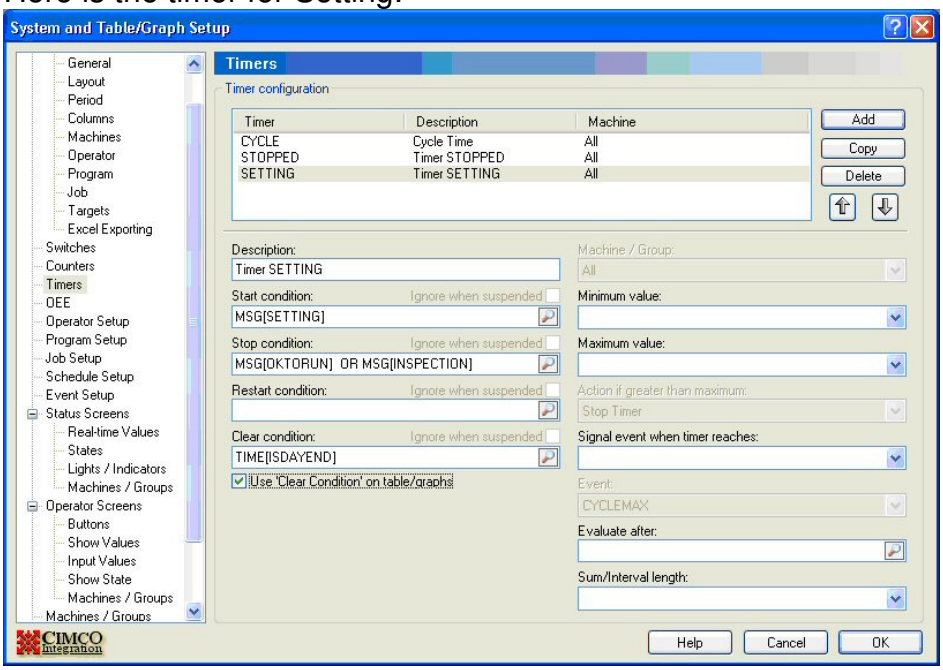
5.6 Downtime Reason Timer Setup

Most customers will want to break down the stopped time (or downtime) by reason. To achieve this they must have a means of entering these downtime reasons which can be achieved by barcode readers on each machine, or a PC in each cell.

To start with you must configure a message for each downtime reason in DNC-Max and a message to put the machine back into normal run mode. See section 1 where we setup two downtime messages – SETTING, INSPECTION and the normal run message OKTORUN.

Now we have to setup a timer for each downtime message. Each downtime timer starts when the barcode (SETTING, INSPECTION etc.) is scanned and runs until the OK to Run barcode is scanned.

Here is the timer for Setting:-



The Start Condition is obvious – the timer starts when the operator scans the "Setting" barcode (and DNC-Max then generates the SETTING message).

The Stop Condition is not so obvious :–
MSG[OKTORUN] OR MSG[INSPECTION]

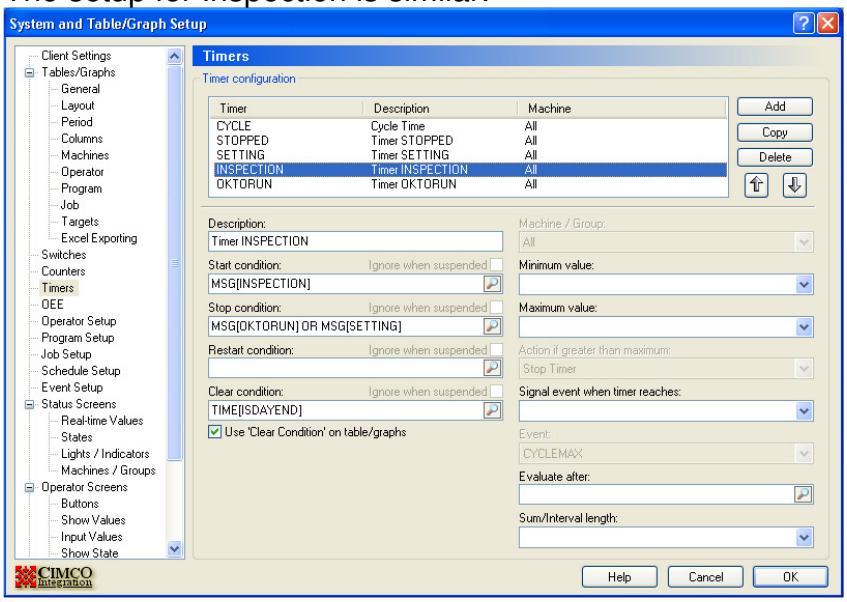
We want the timer to stop when the operator scans "Ok to Run" OR when he scans ANY other downtime reason because the machine can only be in one downtime state at a time. If you had another downtime reason called NOWORK you would need to add OR MSG[NOWORK] as well.

Click into the Stop Condition field, click the search icon, find the MSG[OKTORUN] message and click the Insert button to get the first part of the condition. Then click the OR button which inserts the OR condition. Finally

find the MSG[INSPECTION] message, click the Insert button and then OK the box to add the condition.

The Clear Condition is set to TIME[ISDAYEND] to make sure that the machine is not still in Setting mode at the beginning of a new day. It is cleared for both livescreen and graphs (Use Clear Condition on Table / Graphs).

The setup for Inspection is similar:-



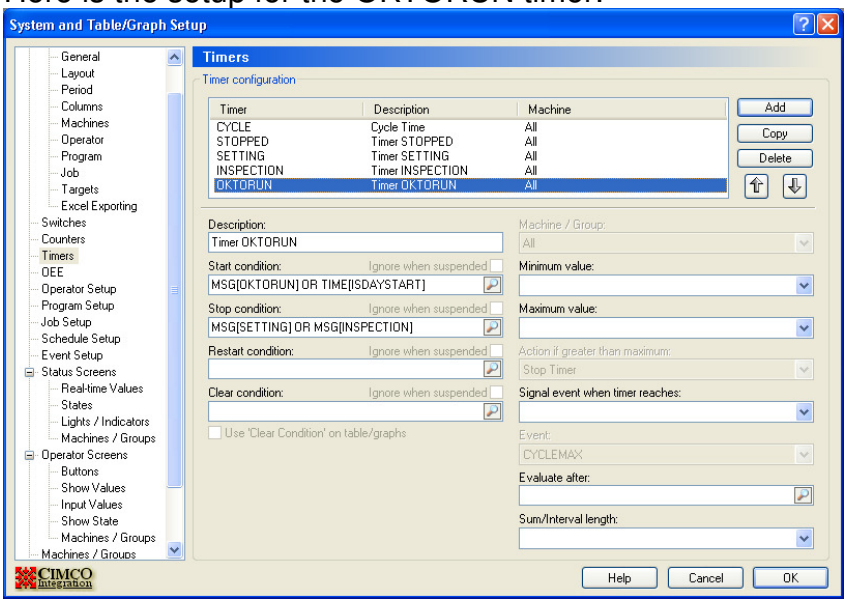
The Start Condition is MSG[INSPECTION] and the Stop Condition is:- MSG[OKTORUN] OR MSG[SETTING] - add this yourself.

Note : The Stop Condition for any downtime timer MUST include the Start condition for all the other downtime timers. Otherwise you would have two timers running for different downtime reasons at the same time.

5.7 OK to Run Timer Setup

Finally we create a timer for OKTORUN – this starts when the operator scans OKTORUN and stops whenever a downtime reason is scanned. We need this so we can ignore cycle times created when the machine is in setting as the operator may be running the program in single block mode and we would otherwise record several short cycles.

Here is the setup for the OKTORUN timer:-

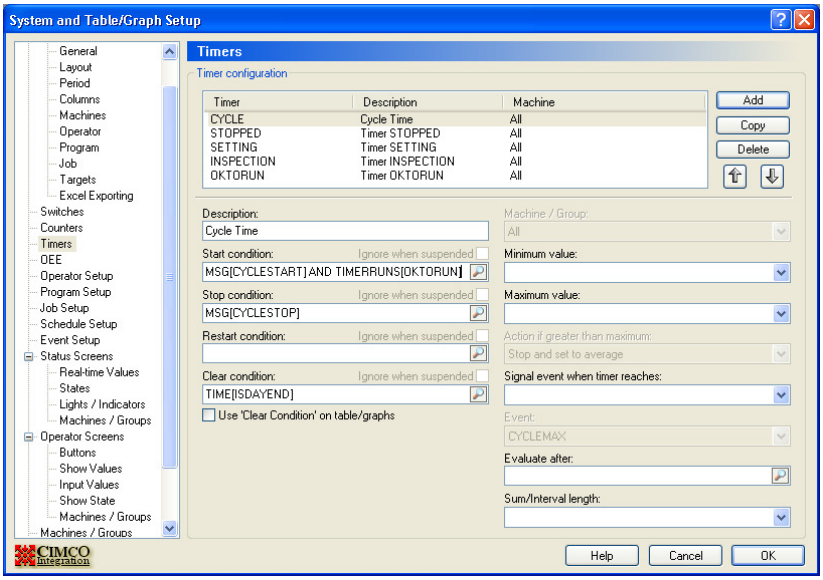


The timer starts when we receive the OKTORUN message (barcode) or the start of the day (we don't want the machine left in setting for several days). It stops whenever a valid downtime reason is swiped – make sure you put every downtime reason in here (separated by OR) as you can have multiple downtime reasons.

5.8 CYCLE Timer modified to ignore Downtime

Now we can modify our CYCLE timer so that it does not run when the machine is down for any reason. We do this by modifying the Start Condition to check that the “OK to Run” timer is running. The variable in MDC-Max for this is TIMERRUNS[timername] and it returns True (timer is running) or False (timer is not running).

Highlight the CYCLE timer and modify the start condition as follows:-



Notice the use of AND in the expression.
MSG[CYCLESTART] AND TIMERRUNS[OKTORUN}

This makes sure that the cycle timer will only start when it receives a CYCLESTART message from the machine AND the OKTORUN timer is running.

5.9 Schedule Setup

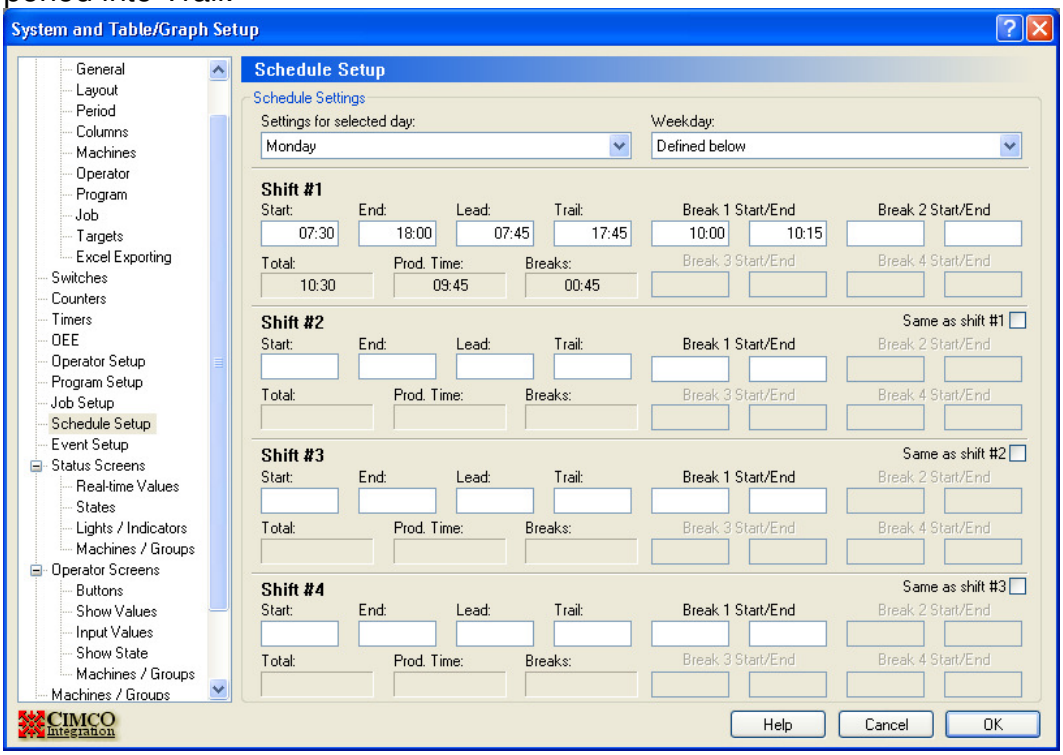
Before you can produce any reports or graphs you must setup a shift schedule – this tells MDC-Max when each shift starts and ends. You can have a different shift setup for every day of the week or several days with the same shifts. You can also have non production days (eg Sunday).

Click Setup System Setup and click Schedule Setup on the left.

Start with Monday and enter the start and end of each shift in the day (if you want to report based on shift) or just enter the total working hours.

Enter any breaks that you don't want to be included in the OEE calculations into Break1 Start/ End.

If the company allows 15 minutes of non production time at the start of the shift (for machine warmup) enter the actual end time of that period in Lead. If the company allows cleandown time then enter the actual start time of this period into Trail:-



If you don't enter any more data Tuesday to Friday will inherit the same shift pattern and Saturday / Sunday will be non production days. Click the drop down box for selected day to fill in different shift patterns for other days.

It is important to point out that if your last shift ends at 6 am the next morning this is counted as the day end and any reports and the livescreens will run from the start of Shift 1 until the end of the last shift.

Shifts cannot overlap but the start of shift 2 can be the same as the end of shift 1.

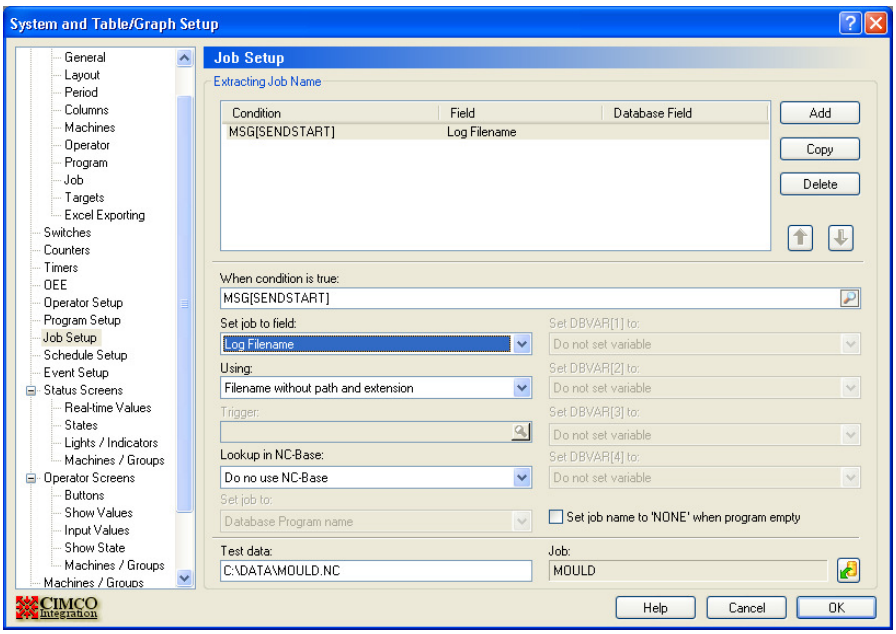
5.10 Setting the Current Job Number

Many customers want to report on each job and to do this we have to have the current jobname running on each machine. This can be done by using the last filename transferred via DNC-Max to the machine or by using a barcode scanner to scan the start of a new job.

These Jobnames can then be used on livescreens and reports.

5.11 Setting the Current Job Number from a DNC-Max transfer

Click Setup, System Setup in MDC-Max.
Click Job Setup on the left and click the Add button on the right.

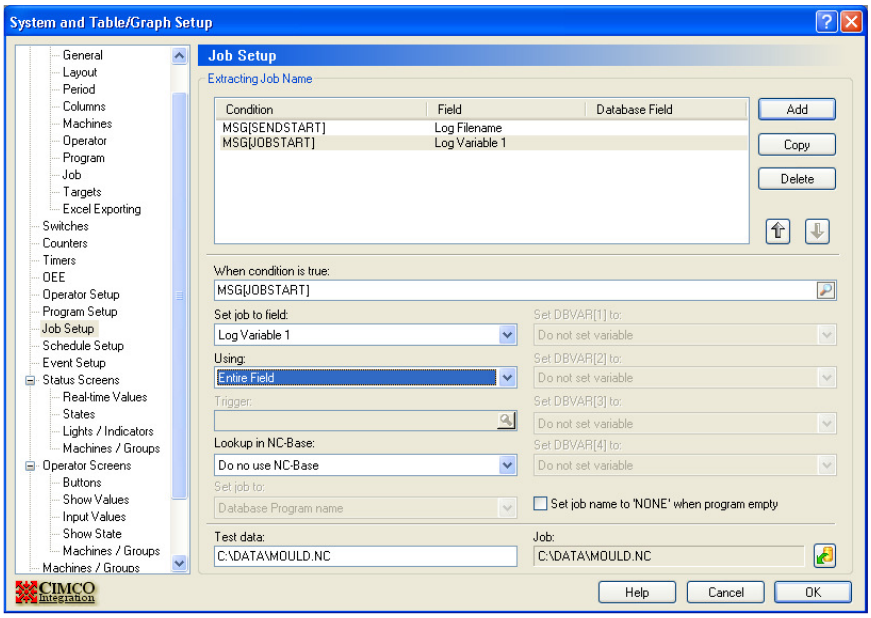


Set the condition to MSG[SENDSTART] – this condition will be true when DNC-Max transfers a new file to the machine.
Set job field to Log Filename – this tells MDC to grab the filename of the file transferred.
Setting the Using Field to “Filename without path and extension” tells MDC to strip the path and file extension so we end up with the filename only.

Note that this method will only work if the operator transfers the program each time they start a new job. If they leave the program in the machine and do not transfer it then this will not work.

5.12 Setting the Job Number from a scanned barcode

Many customers use a barcode to denote the start of a job (see section 1 for details of how to setup these barcode messages) and this is how to set it up:-



Set the condition to MSG[JOBSTART] (setup in section 1).
Set the “Set Job to field” to Log Variable 1 – this is the first variable stored by DNC-Max when it extracts the jobname from the barcode (also in section 1). We use the entire variable this time as the scanned jobname does not include any filenames paths etc.

This is how it works :-

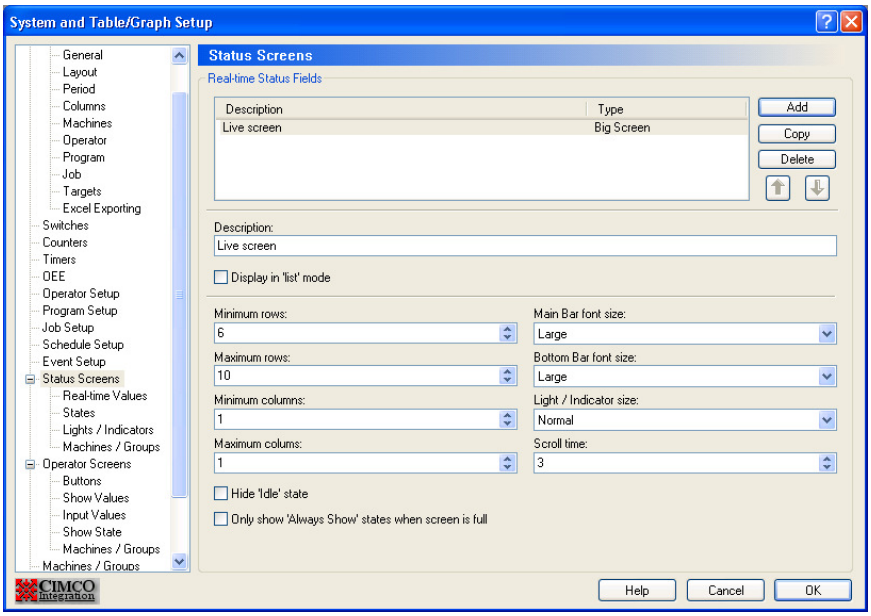
The user scans the start new job barcode (MAXJS) then scans the actual job number from their paperwork (eg 1234).

DNC-Max generates the JOBSTART message and stores 1234 in the Log as variable 1. MDC-Max sees the JOBSTART message and sets the job name to variable 1 which is 1234 in this case.

Chapter 6 - Setting up a live data screen

Once the timers are setup we can display their values on a real time live screen in MDC-Max.

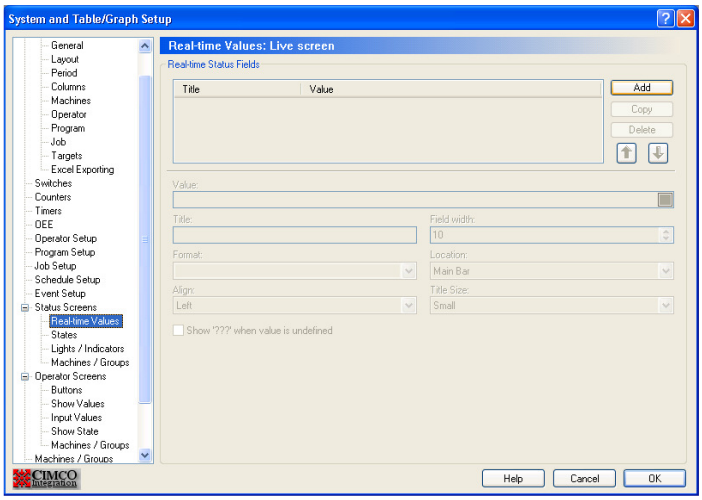
Open MDC-Max Client and then click Setup, System Setup and click on the Status screens section on the left. Click the Add button to the right to add a new status screen and enter the name for the first status screen in the Description: (call it 'Live Screen').



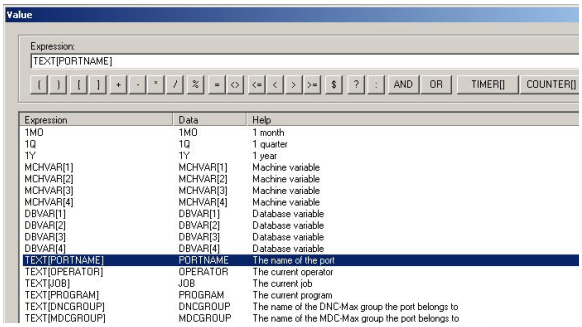
Leave the default rows etc as they are – we will change them later.

6.1 Adding the machine name to the live screen.

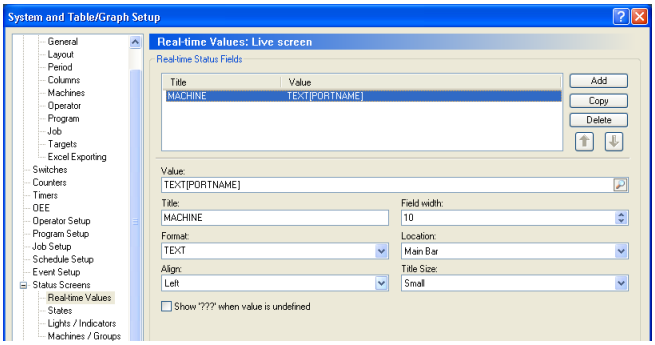
Click on the Real Time Values section on the left below Status Screens and click on Add to the right.



Click on the search icon at the end of the Value bar and this will then bring up the Value screen below, Scroll down to the bottom of the list of values and double click 'TEXT(PORTNAME)'. This will display the name of the machine as you entered it in DNC-Max.

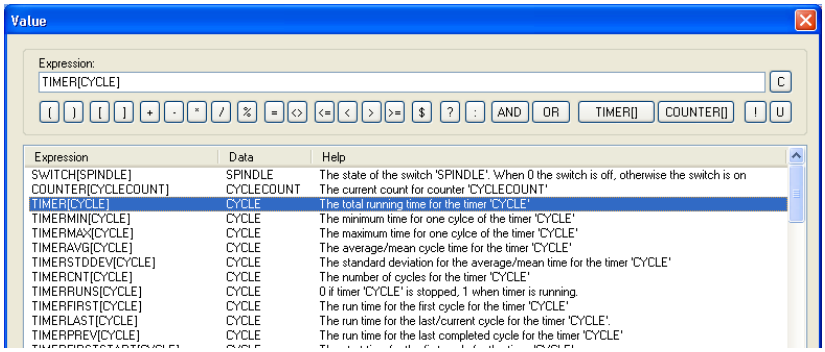


Click on OK to save the value, click into format field and set it to TEXT. This will display the DNC-Max Port name (eg PUMA1) in text format. If you enter a title this will be displayed above the Port name. In general we would leave the title blank as it saves space on the live screen.

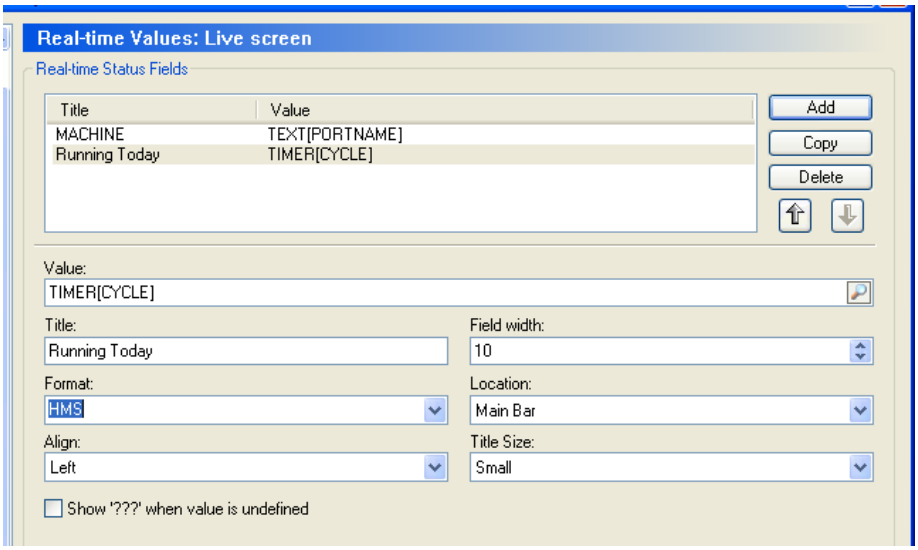


6.2 Adding Cycle times to the live screen

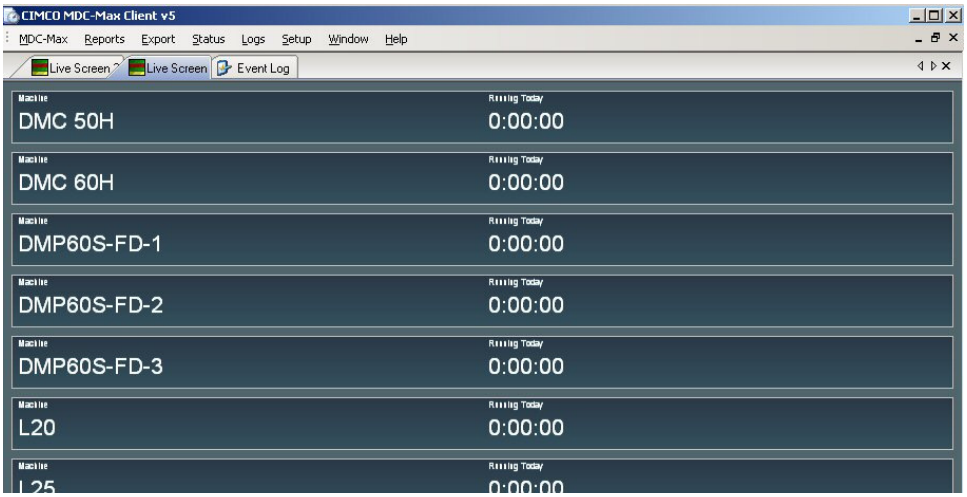
Click on Add, click on the search icon at the end of the Value bar, to display the list of possible values. Double click ‘TIMER[CYCLE]’ and click OK.



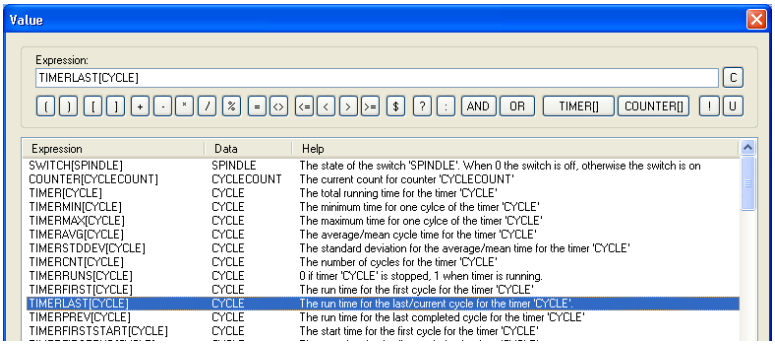
Type in the Title you want to appear on the live screen and set the format to HMS (hours minutes seconds) and alignment to Left.



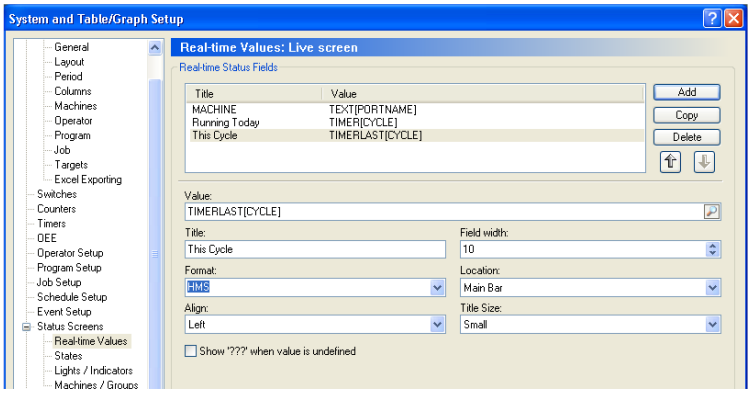
Click OK to close the screen. You have now added a live screen that displays the machine name and the total cycle time so far today. To display this live screen click Status on the MDC-Max client menu, then Live Screen – you will see a screen similar to the one below :-



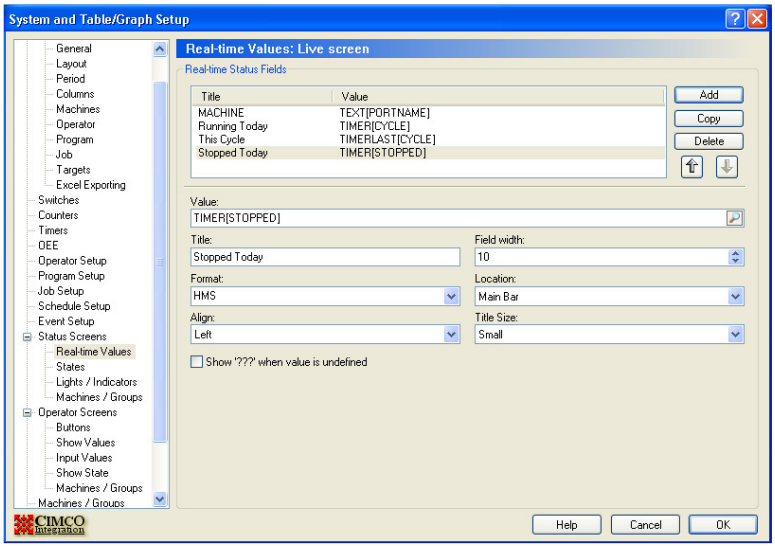
Next we will add the Current Cycle time to the screen.
Click Setup, System Setup, Real-time values, click the Add button and use the search icon in the value box to add TIMERLAST[CYCLE] and click OK.



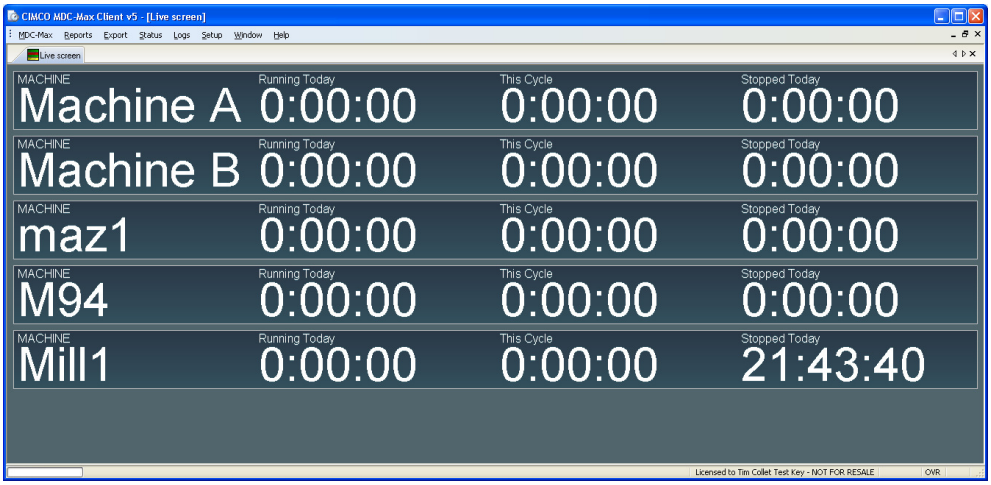
Set the title to “This Cycle” and set the format to HMS.



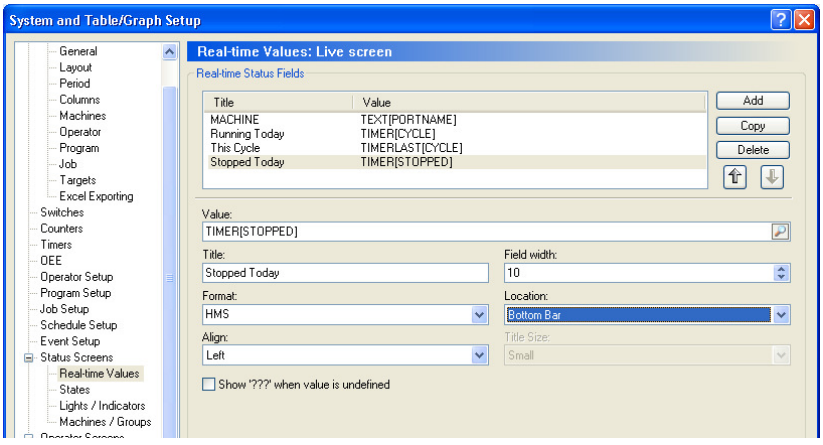
Next add the STOPPED timer with title “Stopped Today” in the same way.



OK these settings and view the live screen – it should look like:-



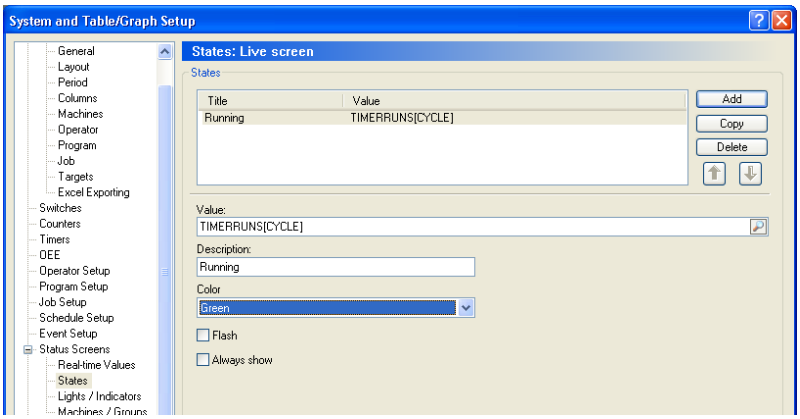
You will soon find that there is too much information to display on one bar on the screen so you can reconfigure the Running Today and Stopped timers to be displayed below the other data in smaller text (referred to as the bottom bar). Change the Stopped Today and Running Today values as follows:-



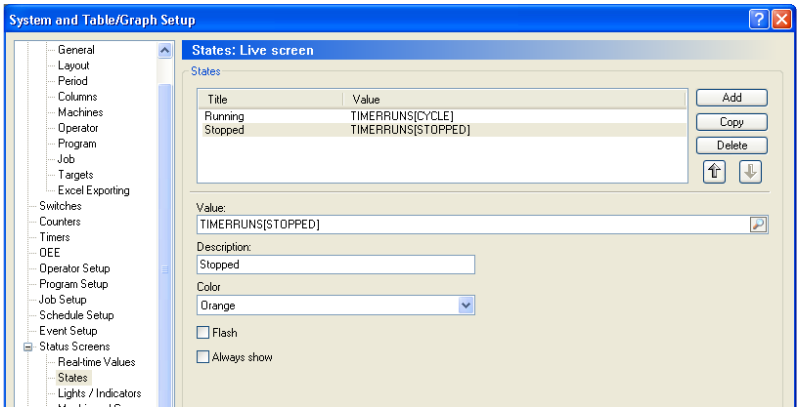
The real time display should now look like this:-

6.3 Changing colour according to machine state

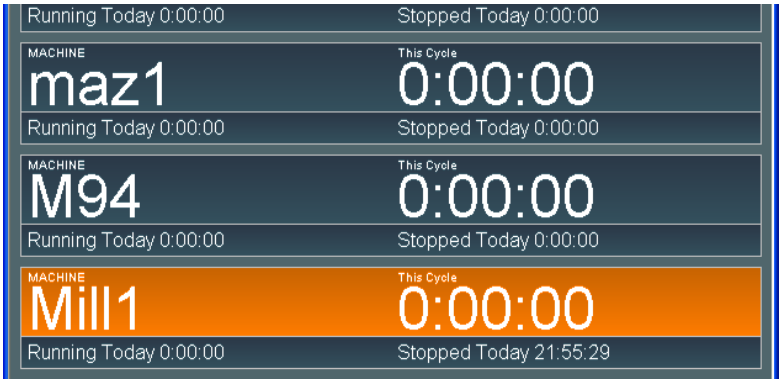
It is useful to change colour depending on the machine state. This gives a quick visual display when you have a lot of machines. For example Green to indicate that the machine is running and Orange that it is stopped. Click Setup, System Setup, then states under Status Screens. Click the Add button to the right to add the running state as below:-



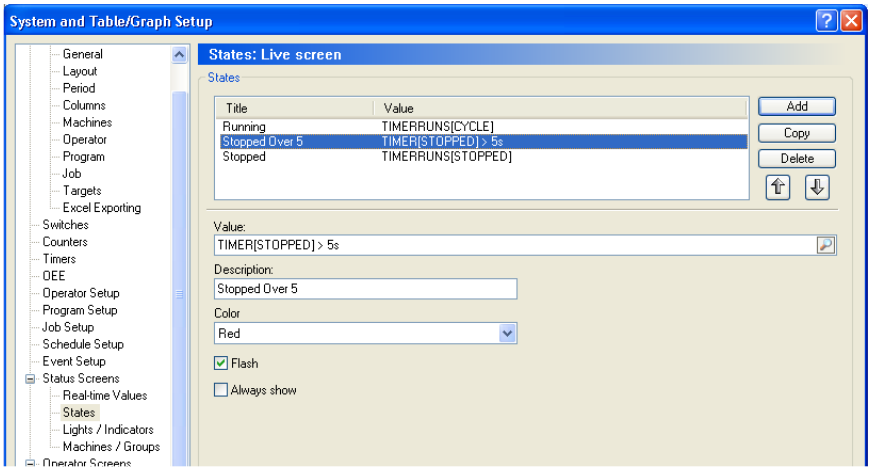
Make sure when you click the search icon for the running state that you choose the value TIMERRUNS[CYCLE]. This is true when the CYCLE timer is running and false when stopped. Add the Stopped state in the same way but choosing TIMERRUNS[STOPPED] for the value and Orange for the colour.



The Real Time Screen should now look like the picture below, with the coloured bar changing from orange to green as the machine stops and starts.



We now want to make the machine flash red if the machine has been stopped for more than a certain time. To do this we need to add a third state as below. In this case we are not just picking a value from a list, we are entering an expression that can be true or false. Use the search icon to pick the TIMER[STOPPED] value and then add > 5s. This state will be displayed if the stopped timer has run for more than 5 seconds (in a real installation this would be 5m but we use 5seconds so we can easily test this state).



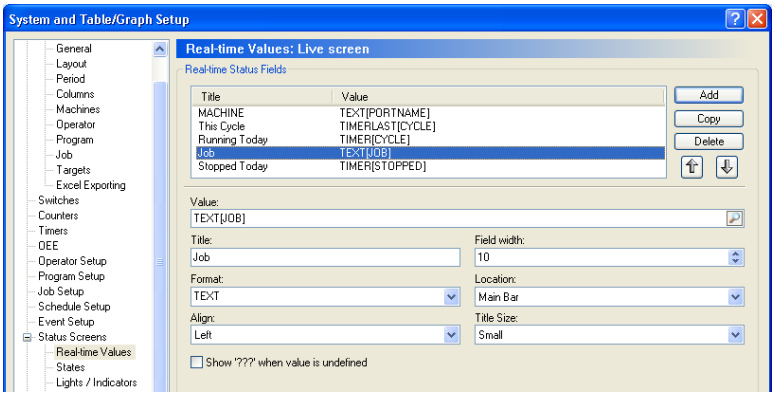
Once you have created this state you need to change the position in the list. Highlight the Stopped Over 5s and then click the Up Arrow button so it is as above.

6.4 Machine State Order on the live screen

MDC-Max will only display one machine state and it does it by checking each state starting from the top and displays the FIRST state that is true, the rest are ignored. So if Stopped comes before Stopped over 5s then Stopped over 5s will never be displayed and the display will not flash after 5 seconds.

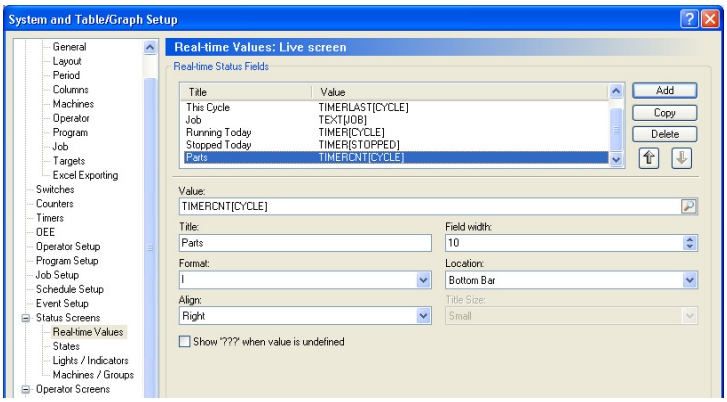
6.5 Adding the jobname to the live screen

Click Setup, System Setup, Realtime values, click the Add button and add the Job:-



6.6 Adding the Part Count to the live screen

Add a new value called Parts and choose the value TIMERCNT[CYCLE] and set the Format to I (for integer) as below:-



6.7 Changing the position of text on the live screen

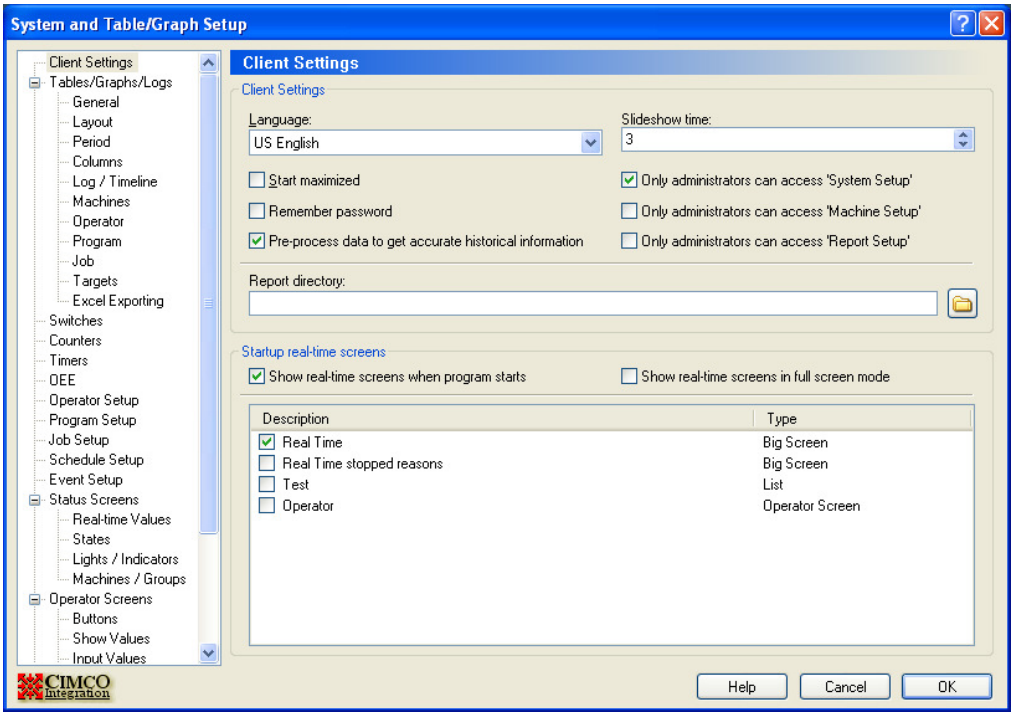
The position of each of the above values on the live screen is determined by their order in the list and by the location field. To change the position, highlight the value in the list and use the Up or Down arrows to the right. Here is an example where we have moved the current cycle and Job Name to the main bar and set the order as Machine Name, then Current Cycle then Job Name:-

There are many other states and values that can be added to the live screen (eg operator, program etc).

6.8 Running a live screen automatically

Most customers will one or more PCs to run a live screen automatically when the MDC-Max client starts (and you can add the client to the Startup group so the client starts when the user logs in).

To do this Open the MDC-Max client, click Setup, System Setup and click Client Settings top Left.



Tick either “Show real-time screens when program starts” or the full screen option to the right to run full screen. Tick the live screen that you want displayed on startup and then OK. Now each time you start that client the ticked live screen will show. If you select more than one live screen they will rotate from one screen to the next according to the time interval set under “Slideshow time”.

Each MDC-Max client can display a different screen on startup. So if you have 5 MDC-Max clients they can all display a different screen.

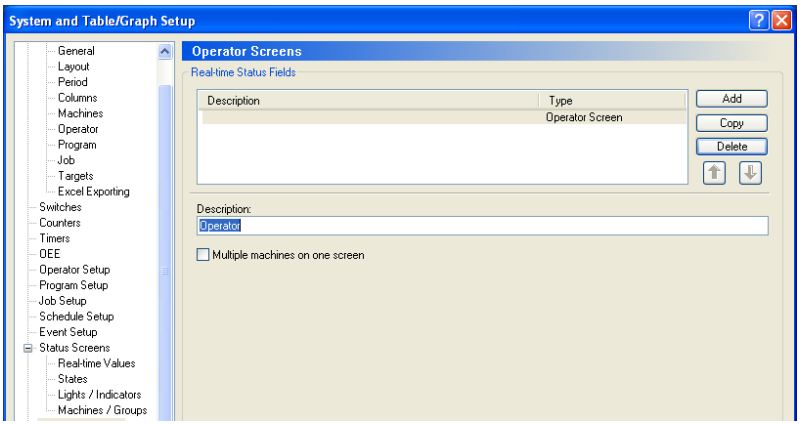
Most customers will require a general screen that shows the runtime today for each machine and its current state. The production office will want to know what job is running on each machine and how many parts have been produced. Each machine cell may well want a screen specific to their group of machines – all of these are possible.

So far we have only created a single live screen but you can create multiple screens and display each one on a separate PC. This is done in the same way we created the first live screen.

Chapter 7 – Setting up Operator Screens for Downtime Reasons

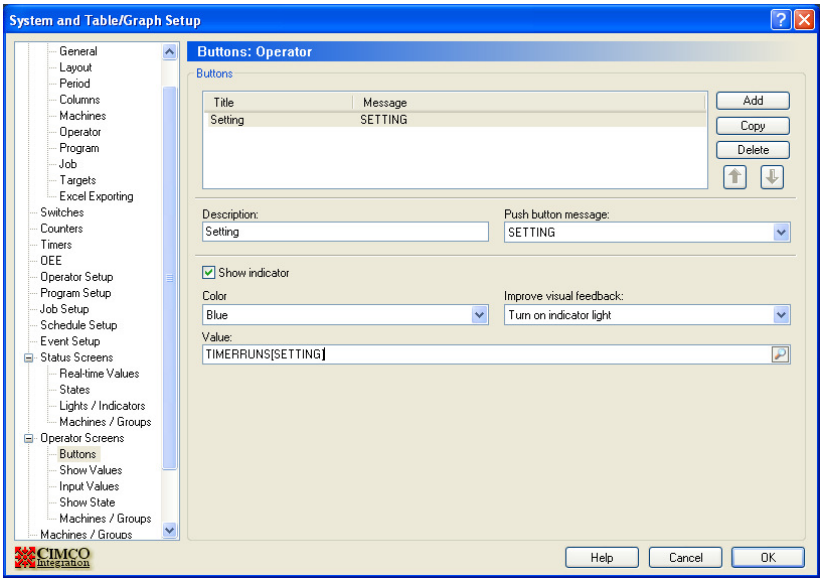
Operator screens enable the operator to enter Operator ID, Job Name, Scrap Part and any Downtime Reasons into the MDC-Max system. The operator screen is created in a similar way to the live screen but now has entry boxes and buttons for data entry. These boxes and buttons can be made large for use with a touch screen PC so that no mouse or keyboard is required.

To set an operator screen up first click Setup, System Setup and click 'Operator screens' on the left. Click the Add button to the right and enter the name for the operator screen in the Description (we have called it Operator Screen). For the time being leave the 'Multiple machines on one screen' box un-checked.



7.1 Adding a Button for Setting Downtime

Go to the buttons menu on the left and click the Add button to the right.



Enter the description as Setting (this text will appear on the button itself) and then click on the Push Button message drop down box. These are a list of the messages that exist in DNC-Max that we created in Section 1 (without the

MSG[…]). When we press this button we want it to send the SETTING message that will start the Setting timer so we choose the SETTING message from the drop down box. If you click OK at this point you will get an operator screen with a single button that says “Setting” on it and sends the SETTING message to MDC-Max when pushed.

Ticking the ‘Show Indicator’ box will light up the button pressed so the operator gets a confirmation of the Setting downtime reason.

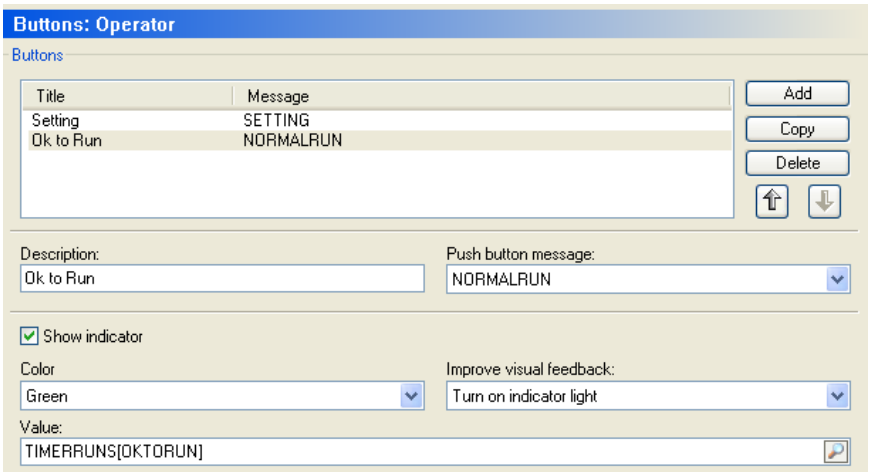
Tick the box and set the indicator colour the same as you did for your Setting state on the live screen (if you put setting on your live screen).

Under Value you enter a timer value for Setting that indicates when the button should light up (as opposed to immediately you press it). In this case we want the button to light up when we are in setting mode (remember that another operator on another screen could have pressed setting for our machine). We are in setting when the setting timer is running so the value we enter is TIMERRUNS[SETTING].

The Improve Visual Feedback’ menu has a series of options. Because there is always a short delay between the button being pressed and the setting timer running and the system visually responding to it there are several options to enhance the display. ‘NO’ just leaves the delay as it is, ‘Turn on indicator light’ turns the light on immediately which prevents the operator clicking several times on the same button.

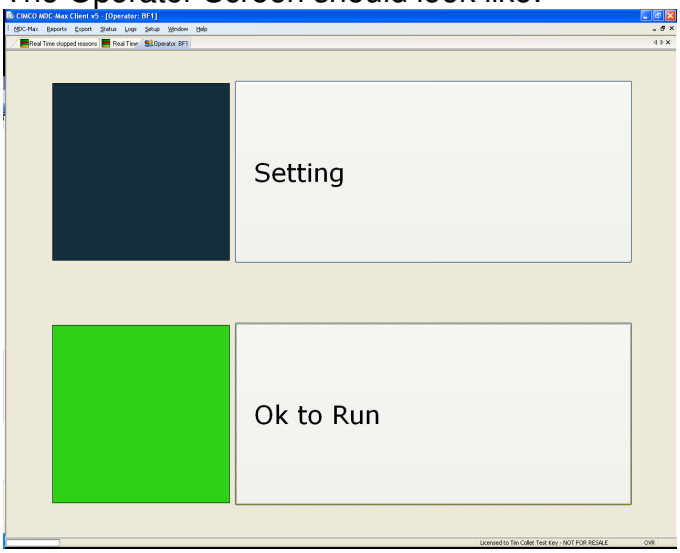
7.2 Adding the OK to Run Button

If the Operator screen is being used for downtime reasons then it should always have an OK to Run button as well. Otherwise the machine will stay in Setting. Here is the setup for the OK to Run button:-



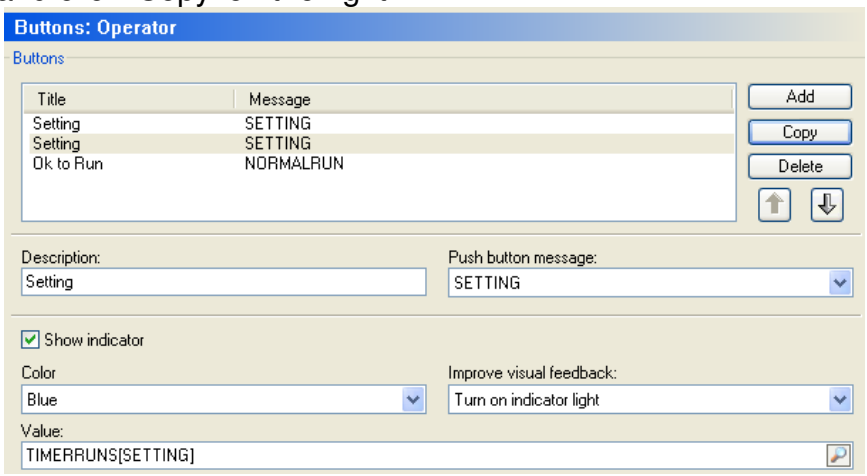
Add this button, OK the settings and then display the Operator screen (Click Status, Operator Screen: Operator Screen from the menu).

The Operator Screen should look like:-

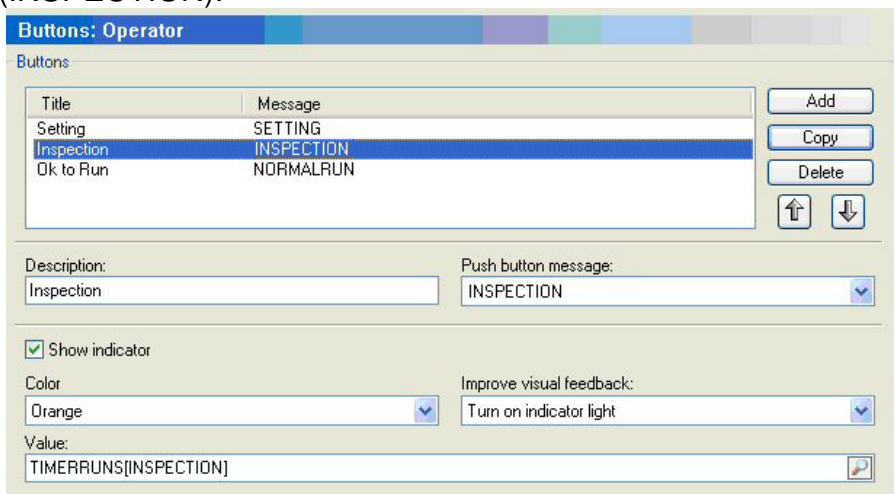


7.3 Adding other Downtime buttons

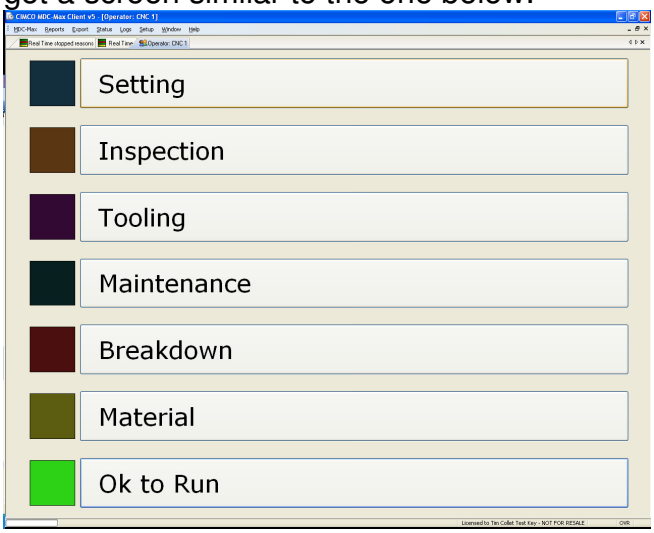
You can now add new buttons to the screen for all the machine downtime reasons. In the Operator screens/buttons menu highlight the Setting button and click 'Copy' on the right.



Enter the description (Inspection), choose a colour and chose the message (INSPECTION).



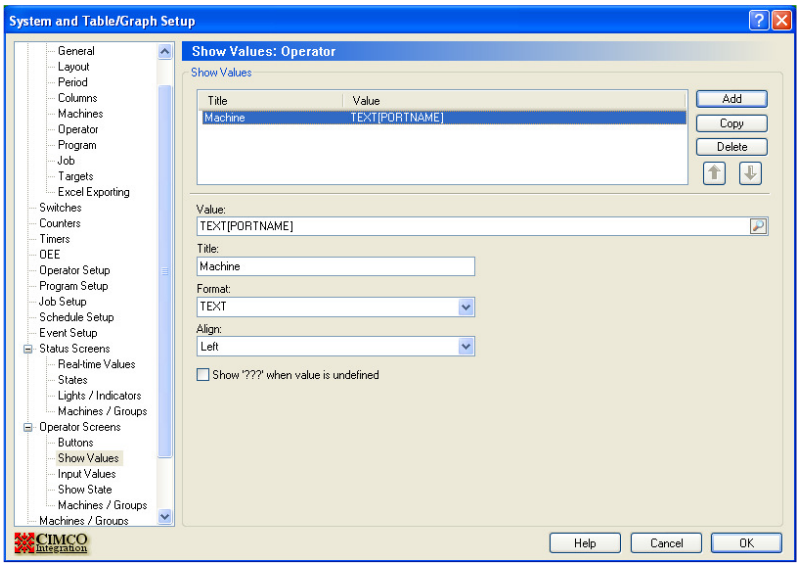
Repeat the procedure for all the other machine stopped reasons and you will get a screen similar to the one below:-



Our example screen has 4 other downtime reasons on it – yours will just have Setting and Inspection.

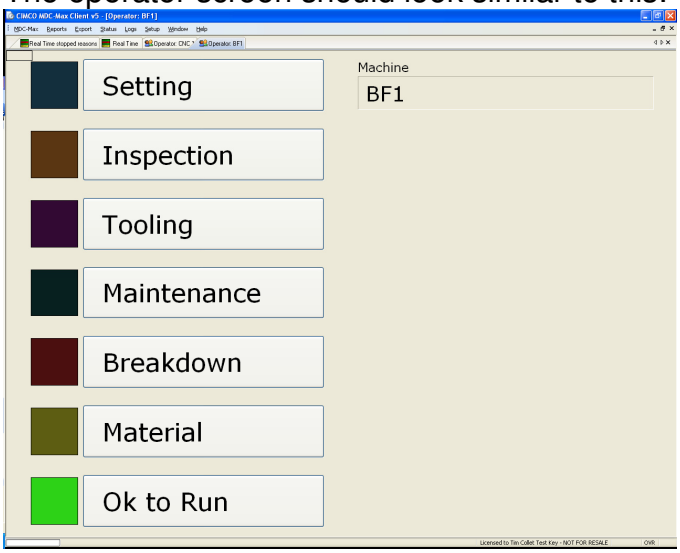
7.4 Adding machine information box to the Operator Screen

It is useful to have the current machine, operator and job on the Operator Screen and these can be added as below. Edit the operator screen, click on Show Values on the left and click the Add button on the right.



Under Value click the search icon and scroll down to TEXT[PORTNAME], set the title as Machine and the Format as TEXT.

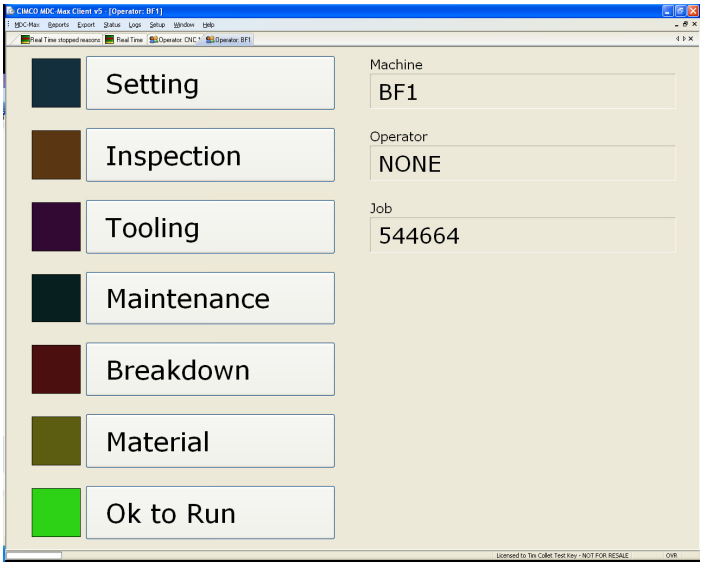
The operator screen should look similar to this:-



7.5 Adding Current Job and Operator ID to the Operator Screen

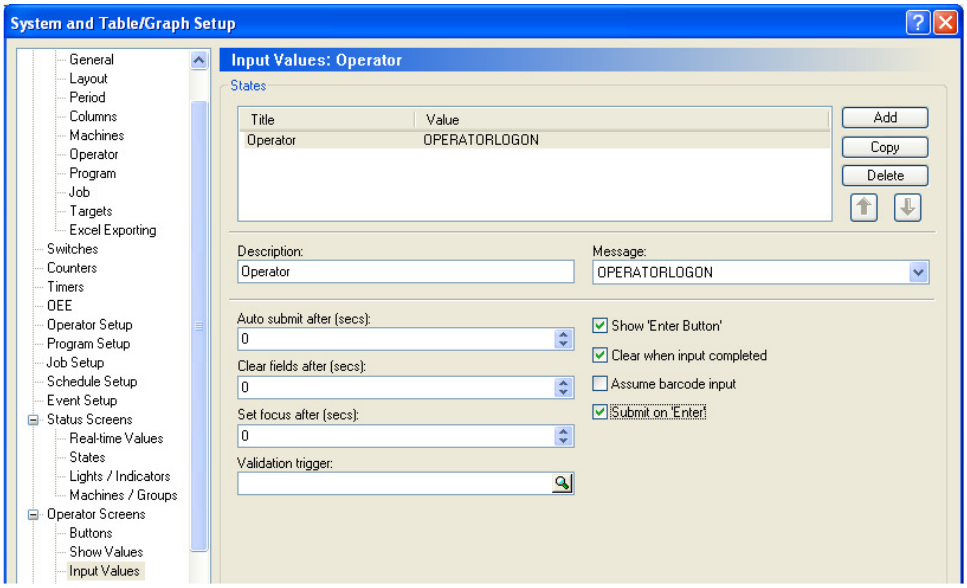
Add two more values by copying the machine value above. Set the value to TEXT[JOB] for the jobname and TEXT[OPERATOR] for operator name and set the format to TEXT.

The end result should look like this:-



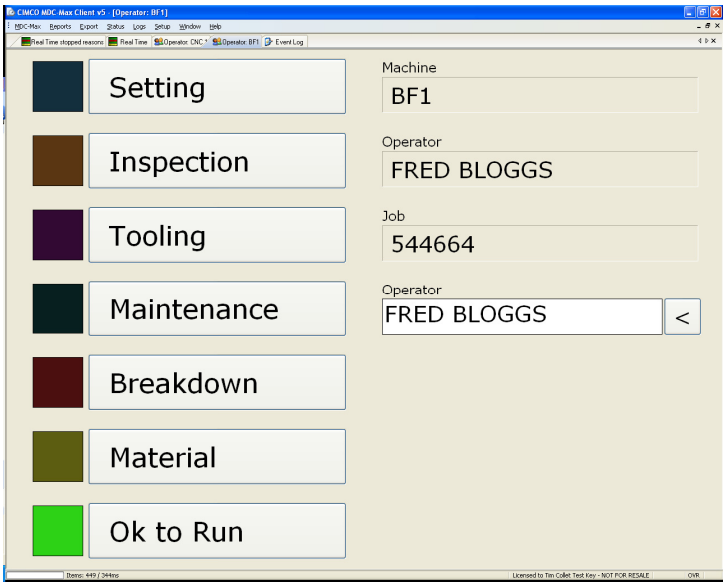
7.6 Adding a data entry box to the Operator Screen

Operator screens can be used to enter text information into MDC-Max (such as job number or operator name). Edit the operator screen, click Input Values on the left and click the Add button on the right.



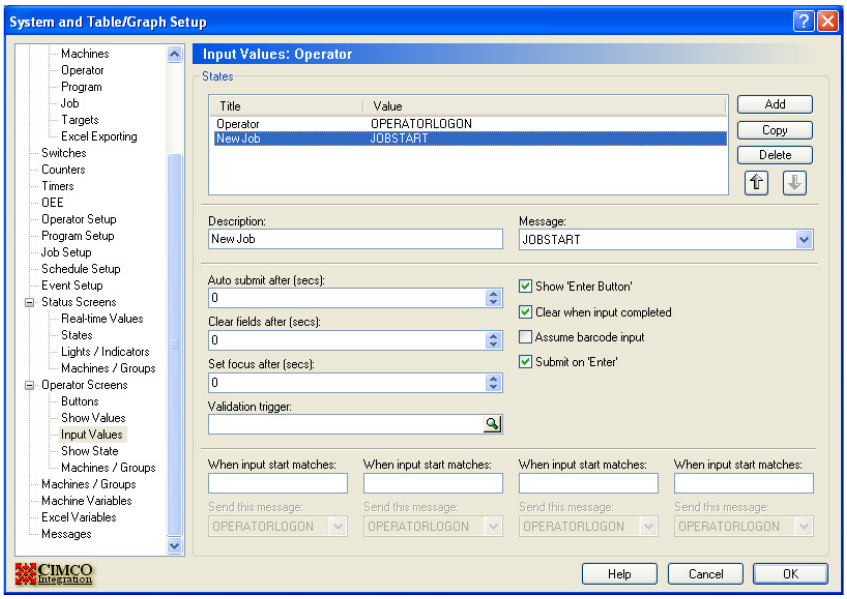
Set the Description to Operator and set the Message to OPERATORLOGIN
The description will appear above the data entry box on the operator screen. The auto submit field will press enter for you if you do not (useful where you only have a number keypad for data entry). The clear field will clear the contents of the box if you do not press enter. The Validation trigger and other fields are for advanced use so leave them blank for now.
The 'Show the enter button' check box puts a mouse clickable enter button beside the input box. 'Clear when input completed' and 'Submit on Enter' are self explanatory.

The result should look like this:-

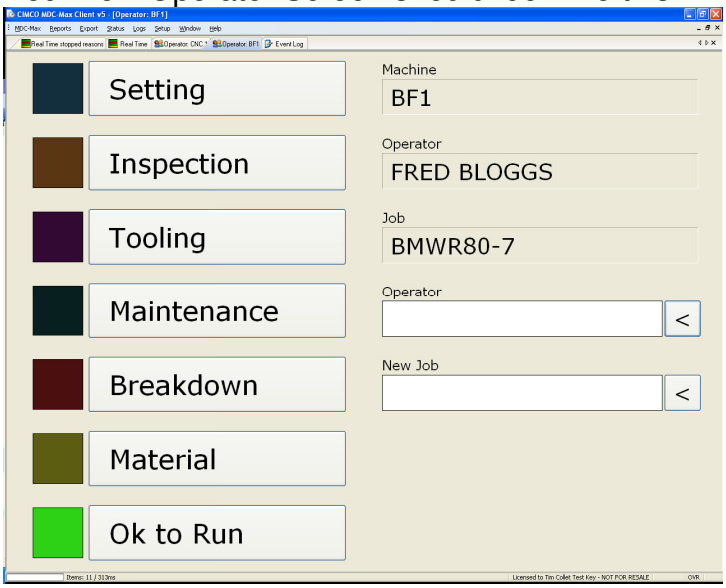


7.7 Adding Job Name data entry box to the Operator Screen

Edit the operator screen, click Input Values, click the Operator value and click Copy. Enter the following information for Job Name :



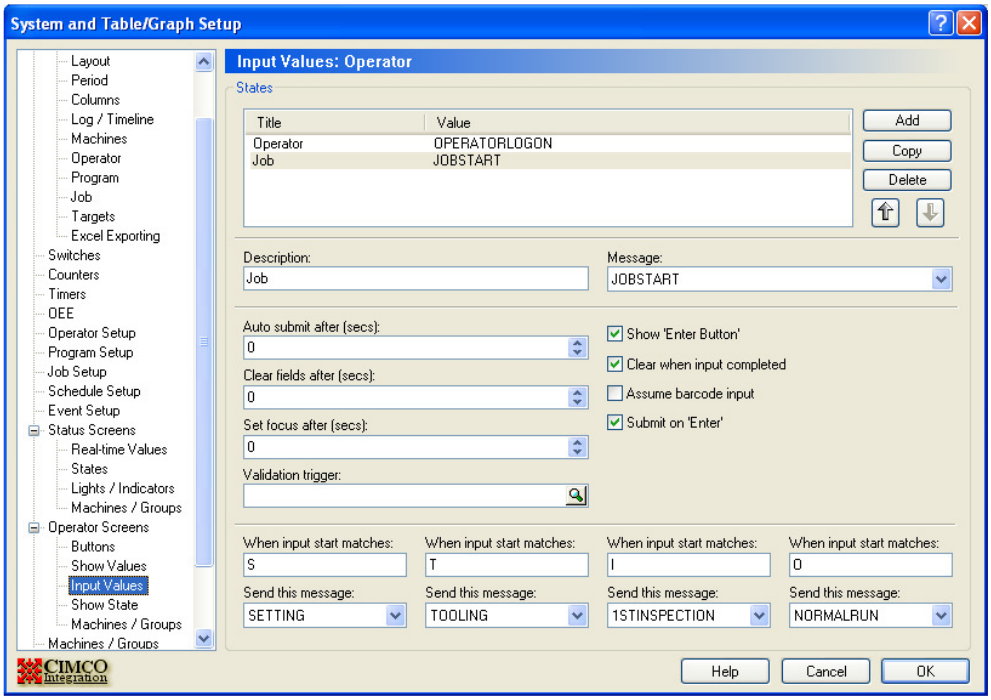
Your new Operator Screen should look like this:-



7.8 Downtime Shortcuts on the Operator Screen

Sometimes it is useful to use a single entry box for multiple downtime reasons without having to setup a button for each. Edit the System Setup and click Input Values and highlight New Job. At the bottom of the screen are a series of “When Input Start Matches” boxes and these can be used to setup upto 4 messages on a single input.

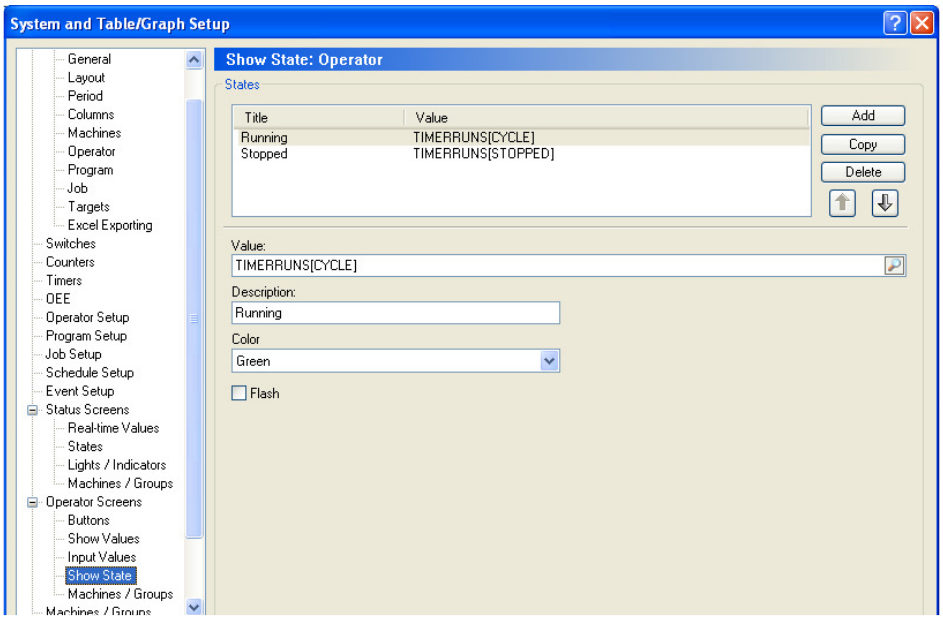
The Example below would enable you to enter just S for Setting, I for Inspection and O for OK to Run.



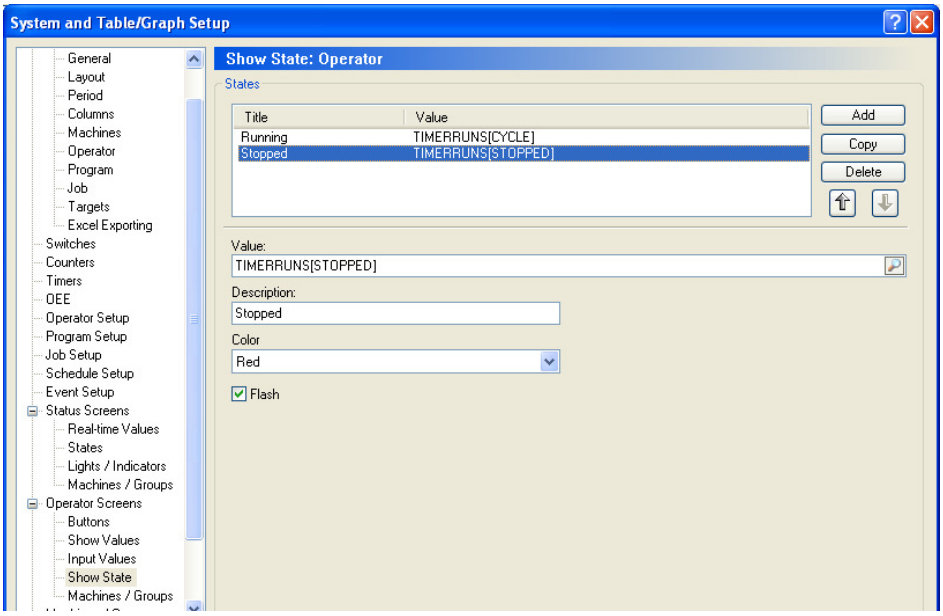
Using an operator screen on a PC in a cell can be much cheaper than fitting bar code readers to every machine. The PC itself can then be fitted with a USB bar code reader (cheaper than the RS232 version) for entry of jobnames and operator ID (you can print a barcode sheet for operator ID and leave it at the PC).

7.9 Adding a Machine State bar to the Operator Screen

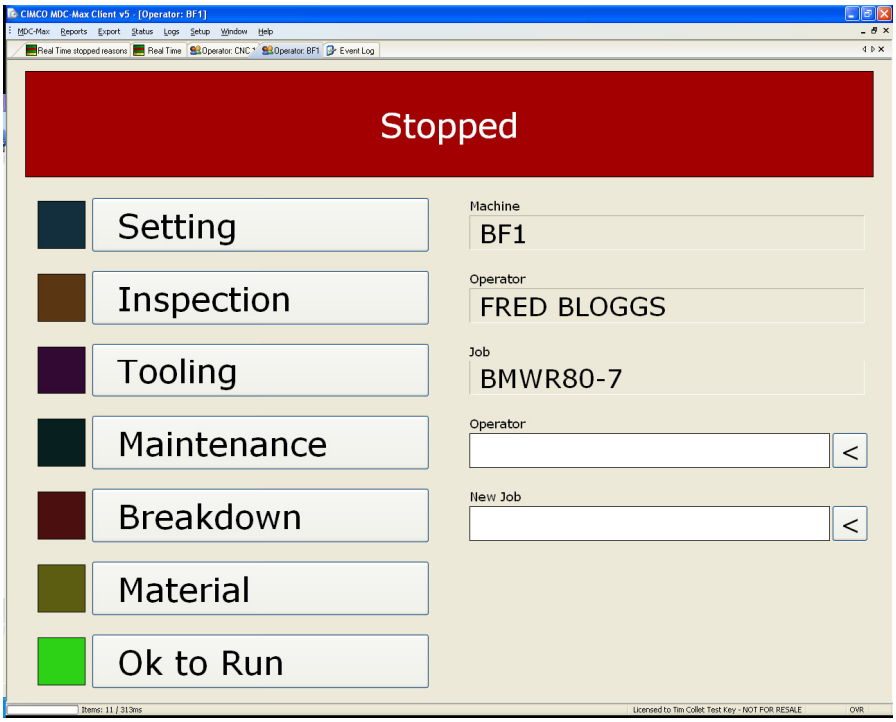
The current machine state can also be displayed on the operator screen, the setup for this is the same as the states in the live screen setup. Click Setup, System Setup, and then states under Operator Screens. Click the Add button to the right to add the running state as below:-



Make sure when you click the search icon for the running state that you choose the value TIMERRUNS[CYCLE]. This is true when the CYCLE timer is running and false when stopped. Add the Stopped state in the same way but choosing TIMERRUNS[STOPPED] for the value and Red for the colour, checking the Flash option makes the red indicator flash to attract the operators attention.



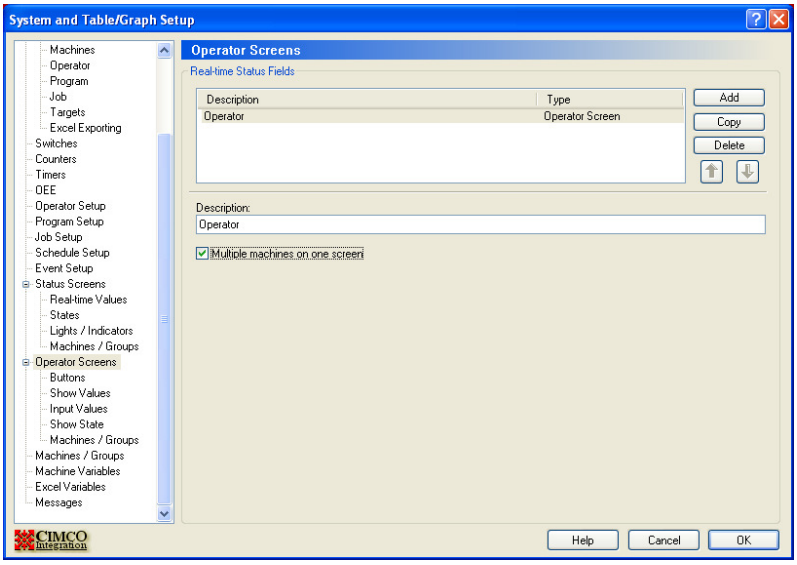
The Real Time Screen should now look like the picture below, with the coloured bar changing from red to green as the machine stops and starts.



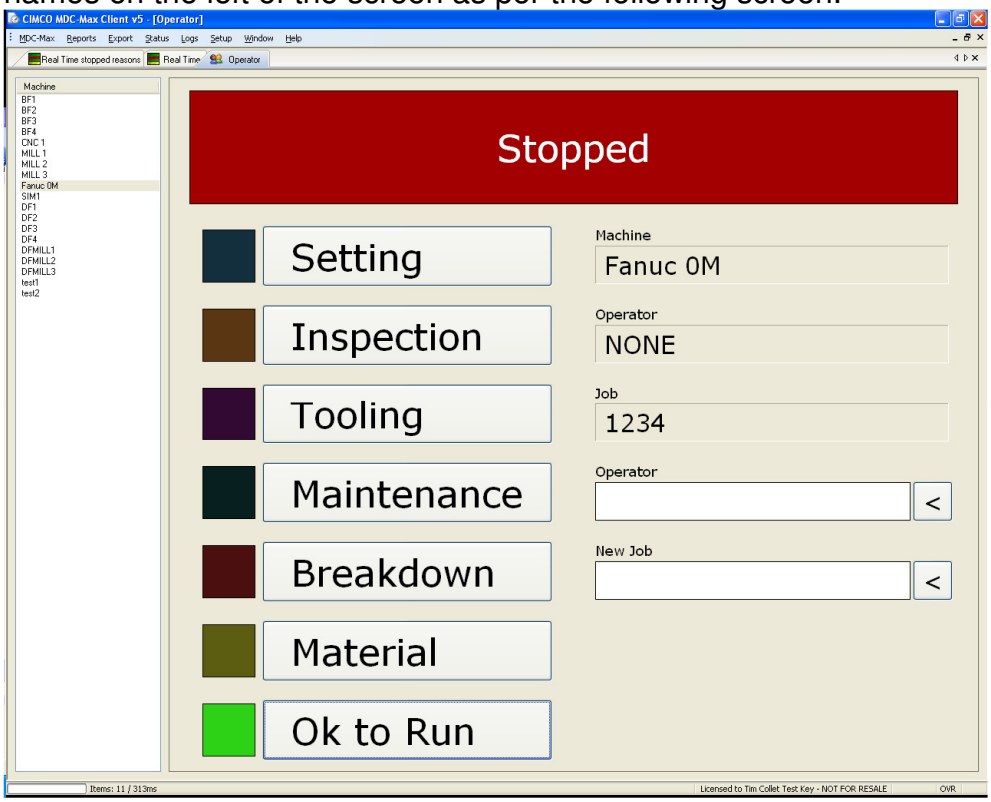
7.10 Displaying Multiple Machines on the Operator Screen

So far the operator screen we have created will ask for a machine name before it displays the screen. But if we have a single PC in a cell serving 4 machines we need to be able to change between machines.

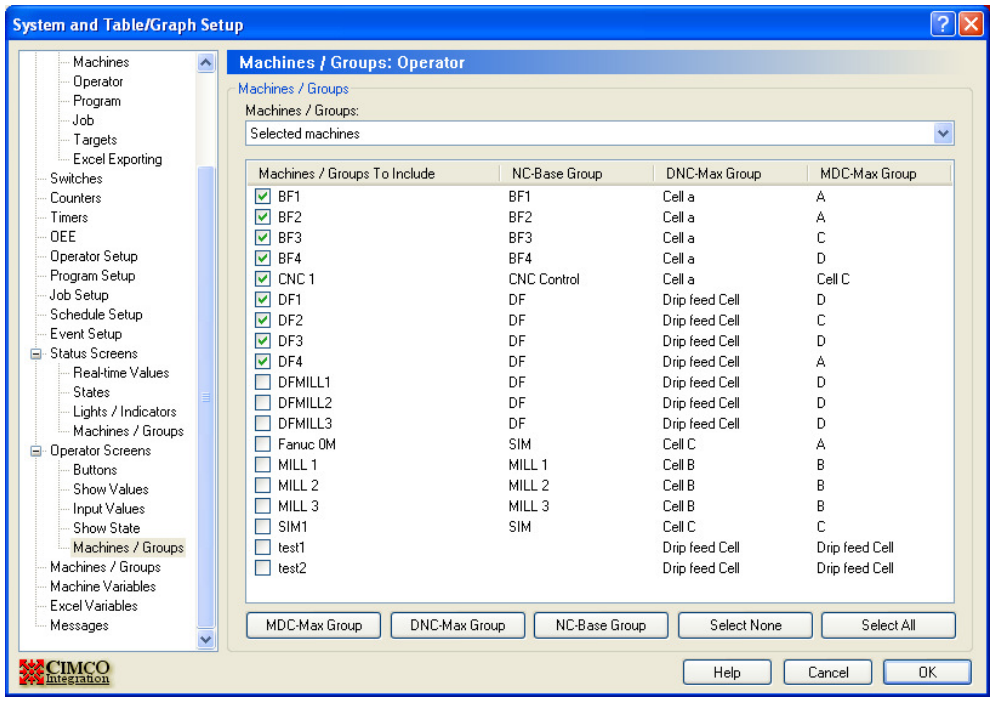
To do this click the check box on the main operator screens menu page that allows multiple machines on one screen.



If this is checked the operator screen will have a list of selectable machine names on the left of the screen as per the following screen.



By default the operator screen will display all the machines. In most cases we want to limit the machine choice to those in the current cell. Edit the operator screen and click Machine / Groups on the left and tick the machines to be displayed on this screen.



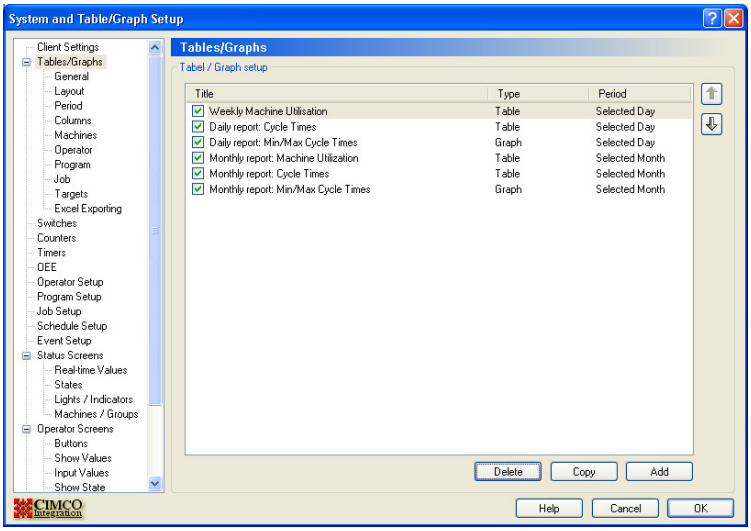
Chapter 8 – Table Reports in MDC-Max

There are 4 different types of report built into MDC-Max and it also has the ability to create customised spreadsheets directly from MDC data. MDC-Max installs several default reports which you can copy and modify. Here we explain how to setup the 4 built in types from scratch.

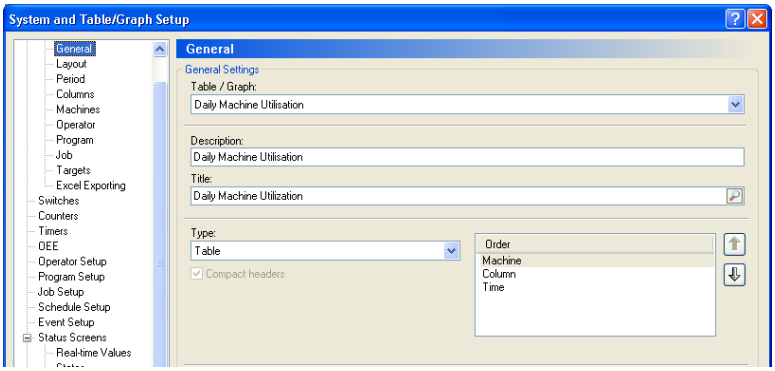
8.1 Setting up machine % utilisation table report

A table contains rows and columns of data for each machine such as run time today, machine efficiency today, stopped time by reason code and so on.

For our first table we will create a simple machine utilisation table.
On the main MDC-Max screen click Setup, System Setup then click on the 'Tables/Graphs' link on the left.



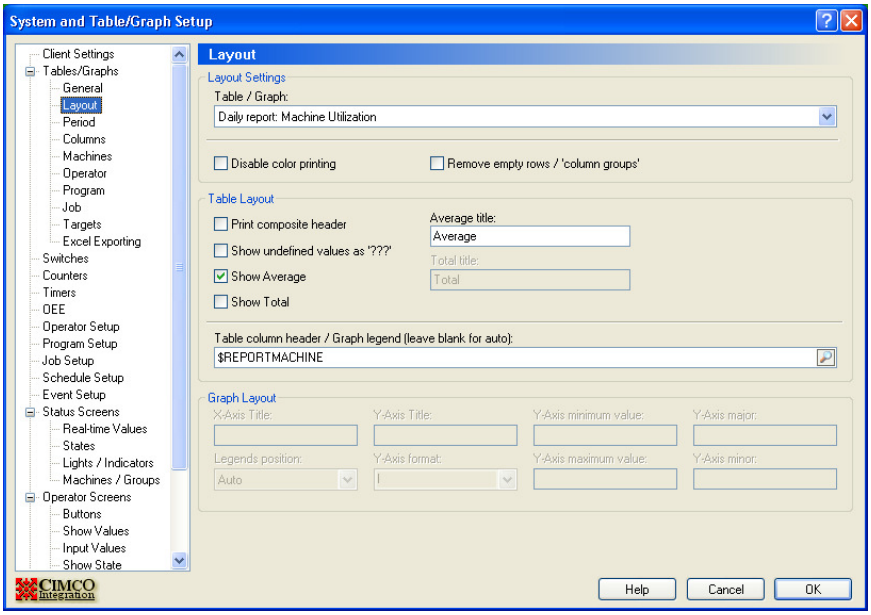
Click the Add button to see the screen below and type a description in the Description field – this is the name of the table. Type a title in the Title field – this is what is displayed on the actual table (they can be the same as below).



Leave the type set to Table – this produces a simple two dimensional table in a grid form.

8.2 Formatting the Table Report

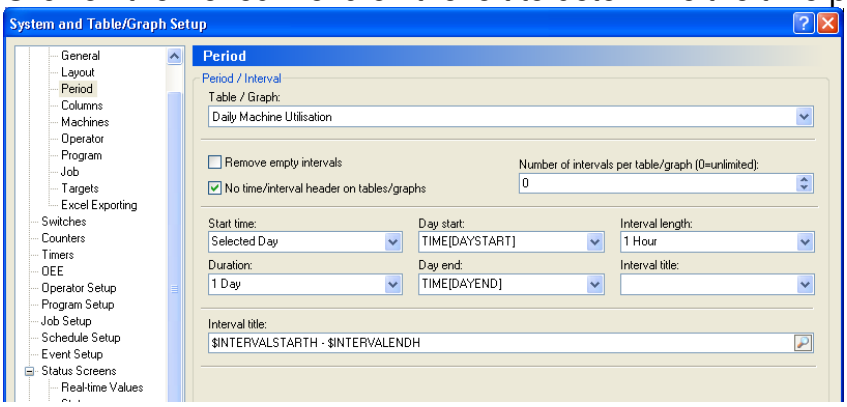
Click on the Layout menu on the left of the screen and the layout page will appear



The layout determines how the data will be laid out on the screen and whether the average and total values are to be displayed. For our simple utilization table we set the table column header to be $REPORTMACHINE (use the search button at the end of the line to pick this). Each column in our table will then be named by machine name.

8.3 Setting the table time period

Click on the Period menu on the left to determine the time period of the table.



"Start Time" and "Duration" determine the total period of the table. Selected Day means that when we run the table the user will be able to select a day from a calendar. We want to report on a single day so the duration is 1 day.

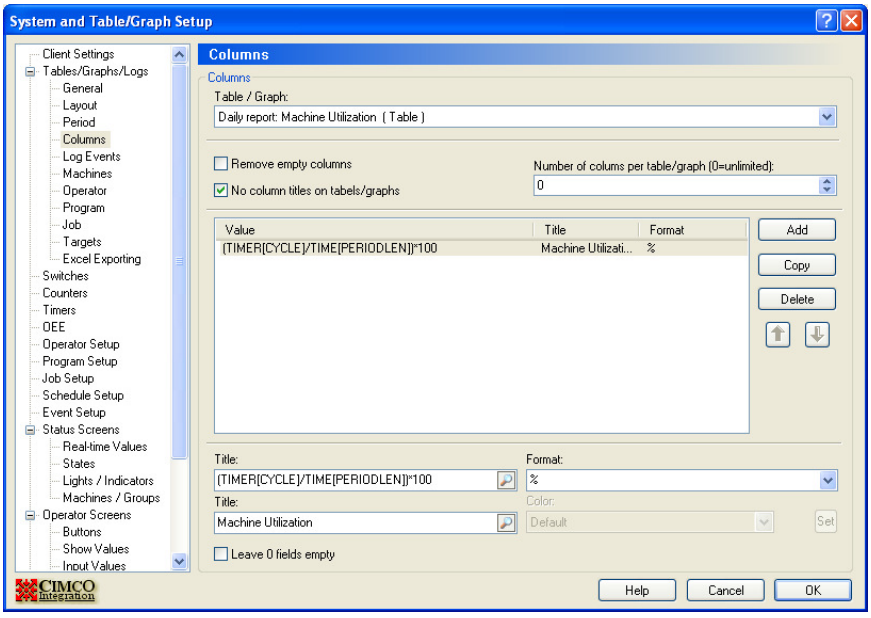
The interval length determines how many rows of data will be generated for each machine per day. If we set this to 1 Day then we will get a row per machine for the total utilization for that day. We can refine this down to 15 minute intervals but for now set this to 1 hour. This means we will get one row for every hour of the scheduled day (see earlier section on setting schedule).
The “Day Start” field is set to TIME[DAYSTART] – this means the table will start at the beginning of the first shift.
The “Day End” is set to TIME[DAYEND] so the table ends at the end of the final shift.

If your first shift starts at 6 am and you run three shifts ending at 6 the next morning, the table above will run from 6 to 6, not from Midnight to Midnight.

The smaller interval title field determines the column period title on the table (this will default to time if you leave it blank. The large interval title field determines what is displayed in the period column (in this case the hour at the start and end of the interval – eg 06-07), the search icon gives a list of suggestions. If you set the large interval title to
$INTERVALSTARTHH:$INTERVALSTARTM - $INTERVALENDHH:$INTERVALENDM
then the time will be displayed as 06:00-07:00 which is better.

8.4 Adding Data to a Table Report

Click on the Columns menu on the left to determine what values are displayed



Each table can display multiple columns of data per machine but in this example we only want the utilization as a percentage. Click on the first Title value and then use the search icon to select TIMER[CYCLE]. This would give us the actual run time in minutes and seconds in that hour.

What we actually want is the percentage runtime in each hour so we must enter a formula to give us this. The formula we want is :
(TIMER[CYCLE] / TIME[PERIODLEN])*100

Ie divide the actual runtime by the interval time (1 hour) and then multiply by 100 to get a percentage. Always use TIME[PERIODLEN] for the total time in any interval – then if you change the interval to 15M or 1 Day the formula will still work.

Use the search icon to edit the Title value and then scroll to the bottom of values to find TIME[PERIODLEN] and double click to add this into the formula and then type the brackets and the *100.

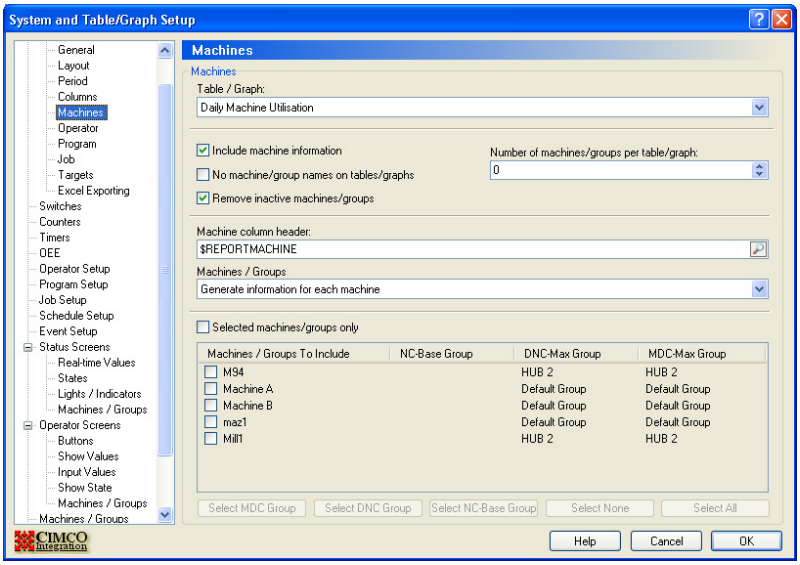
The Format determines how the data is to be displayed (the drop down menu icon gives a series of valid formats) in this case we use % to display a percentage.

Other typical values for the title and format are :

TIMER[CYCLE] to give the total running time (set format to MS for minutes/secs)
TIMERMIN [CYCLE] to give a minimum cycle time (format MS)
TIMERMAX[CYCLE]to give a maximum cycle time (format MS)
TIMERAVG[CYCLE] to give an average cycle time (format MS)
TIMERCNT[CYCLE] to give a part count (format I for integer)

8.5 Selecting which machines to display in a Table Report

Finally click the Machines menu on the left to edit machine info.
This page determines how the data is displayed by machine and what machines to include.

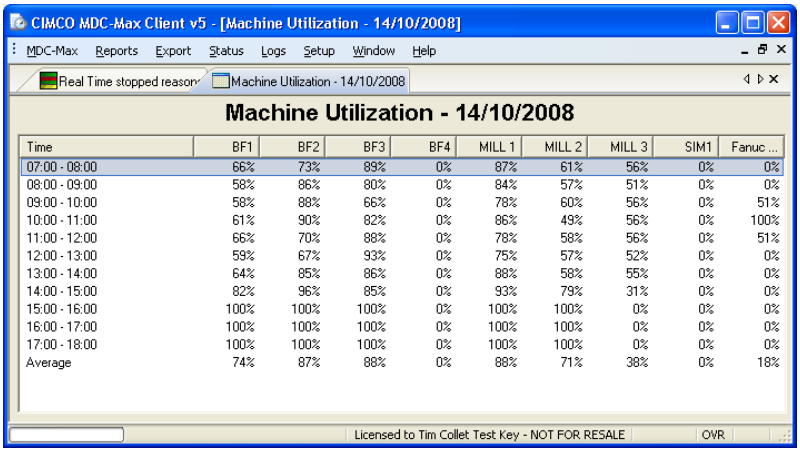


Tick the “Include machine information” field and this will break the table into individual machine totals.
The “Number of machines/groups per table/graph” field determines how many machines will be displayed on each page. If you have a large number of machines, set this to 8 and you will only get 8 machines per table.

Ticking “Remove inactive machines/groups” stops the table displaying empty columns for inactive machines where there is always zero utilisation.
The ‘Machine column header’ determines what is displayed at the top of each column.

Set the “Machine/groups” field as follows :-
Generate information for each machine – all machines are displayed in DNC-Max order.
Generate info for each – group by DNC-Max – all machines are displayed, one table per DNC-Max group (eg Milling & Turning).

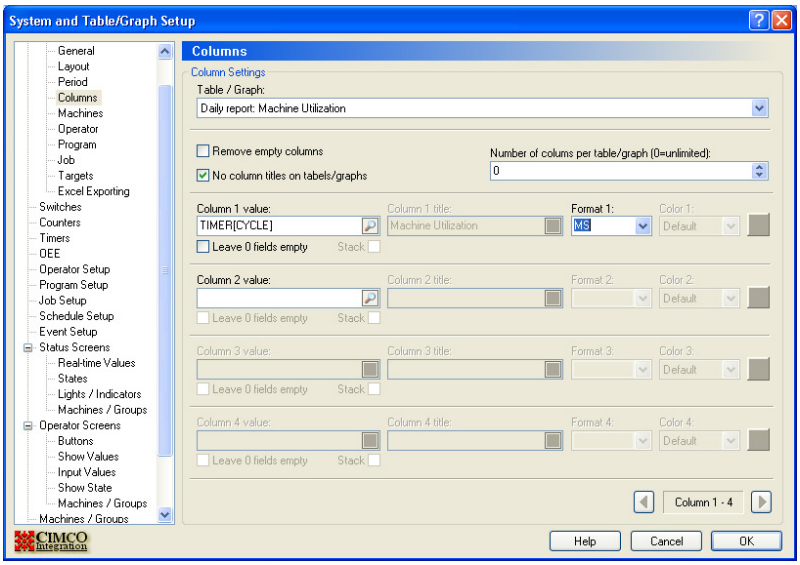
If the ‘Selected machines/groups’ field is ticked you can select the machines to be displayed from the list below. This is useful if you want to report on an individual cell.
Here is the chart generated by the settings in our screen shots:



Time	BF1	BF2	BF3	BF4	MILL 1	MILL 2	MILL 3	SIM1	Fanuc ...
07:00 - 08:00	66%	73%	89%	0%	87%	61%	56%	0%	0%
08:00 - 09:00	58%	86%	80%	0%	84%	57%	51%	0%	0%
09:00 - 10:00	58%	88%	66%	0%	78%	60%	56%	0%	51%
10:00 - 11:00	61%	90%	82%	0%	86%	49%	56%	0%	100%
11:00 - 12:00	66%	70%	88%	0%	78%	58%	56%	0%	51%
12:00 - 13:00	59%	67%	93%	0%	75%	57%	52%	0%	0%
13:00 - 14:00	64%	85%	86%	0%	88%	58%	55%	0%	0%
14:00 - 15:00	82%	96%	85%	0%	93%	79%	31%	0%	0%
15:00 - 16:00	100%	100%	100%	0%	100%	100%	0%	0%	0%
16:00 - 17:00	100%	100%	100%	0%	100%	100%	0%	0%	0%
17:00 - 18:00	100%	100%	100%	0%	100%	100%	0%	0%	0%
Average	74%	87%	88%	0%	88%	71%	38%	0%	18%

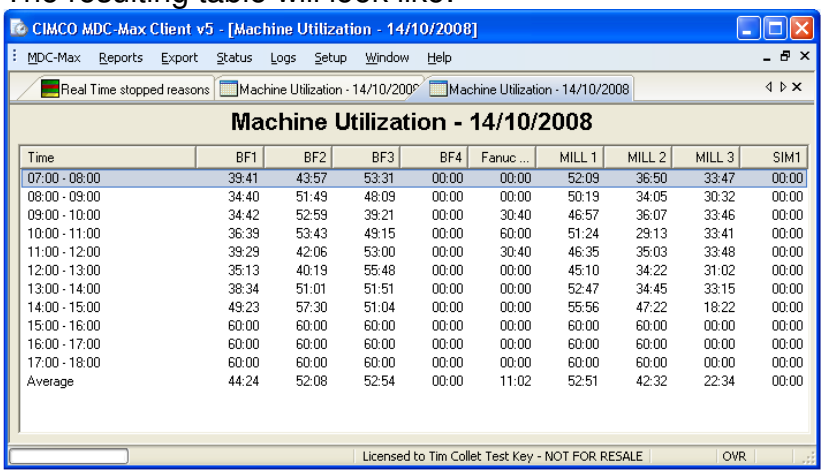
8.6 Displaying Run time in Min/Secs in a Table Report

To create a table of actual run times in minutes seconds change the Column settings to:



The Column 1 values is just TIMER[CYCLE] and the format is MS.

The resulting table will look like:-

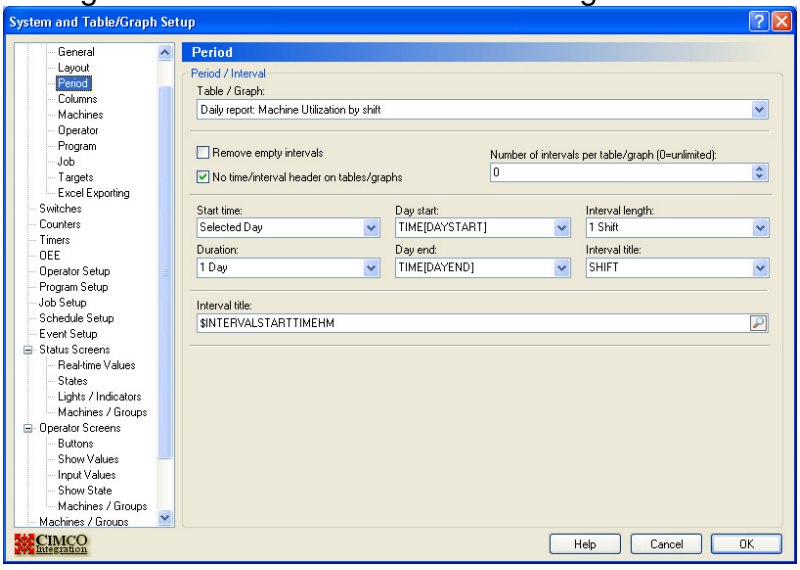


Machine Utilization - 14/10/2008

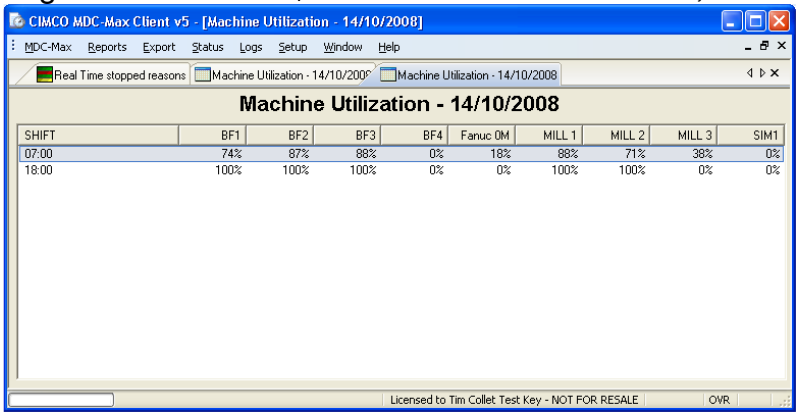
Time	BF1	BF2	BF3	BF4	Fanuc ...	MILL 1	MILL 2	MILL 3	SIM1
07:00 - 08:00	39:41	43:57	53:31	00:00	00:00	52:09	36:50	33:47	00:00
08:00 - 09:00	34:40	51:49	48:09	00:00	00:00	50:19	34:05	30:32	00:00
09:00 - 10:00	34:42	52:59	39:21	00:00	30:40	46:57	36:07	33:46	00:00
10:00 - 11:00	36:39	53:43	49:15	00:00	60:00	51:24	29:13	33:41	00:00
11:00 - 12:00	39:29	42:06	53:00	00:00	30:40	46:35	35:03	33:48	00:00
12:00 - 13:00	35:13	40:19	55:48	00:00	00:00	45:10	34:22	31:02	00:00
13:00 - 14:00	38:34	51:01	51:51	00:00	00:00	52:47	34:45	33:15	00:00
14:00 - 15:00	49:23	57:30	51:04	00:00	00:00	55:56	47:22	18:22	00:00
15:00 - 16:00	60:00	60:00	60:00	00:00	00:00	60:00	60:00	00:00	00:00
16:00 - 17:00	60:00	60:00	60:00	00:00	00:00	60:00	60:00	00:00	00:00
17:00 - 18:00	60:00	60:00	60:00	00:00	00:00	60:00	60:00	00:00	00:00
Average	44:24	52:08	52:54	00:00	11:02	52:51	42:32	22:34	00:00

8.7 Machine Utilisation broken down by Shift

Change the Period screen to the following:



We changed the interval length to 1 Shift, the interval title to SHIFT and the large interval title to $INTERVALSTARTTIMEHM, the table looks like :



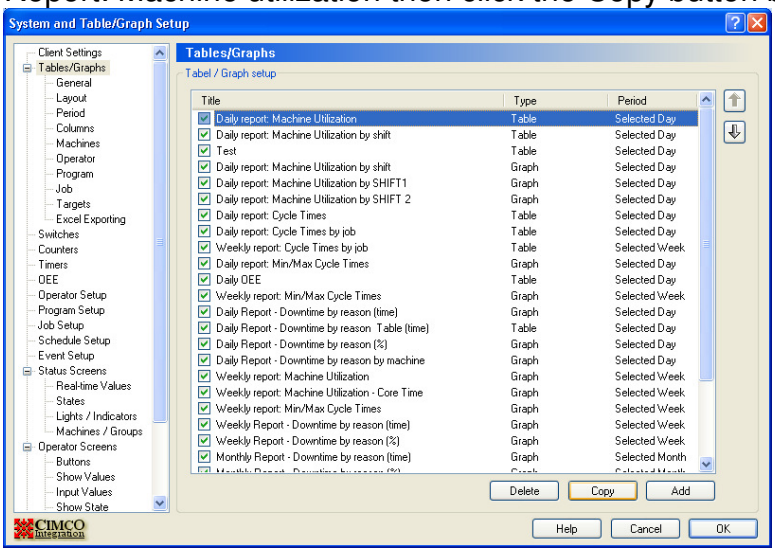
Machine Utilization - 14/10/2008

SHIFT	BF1	BF2	BF3	BF4	Fanuc 0M	MILL 1	MILL 2	MILL 3	SIM1
07:00	74%	87%	88%	0%	18%	88%	71%	38%	0%
18:00	100%	100%	100%	0%	0%	100%	100%	0%	0%

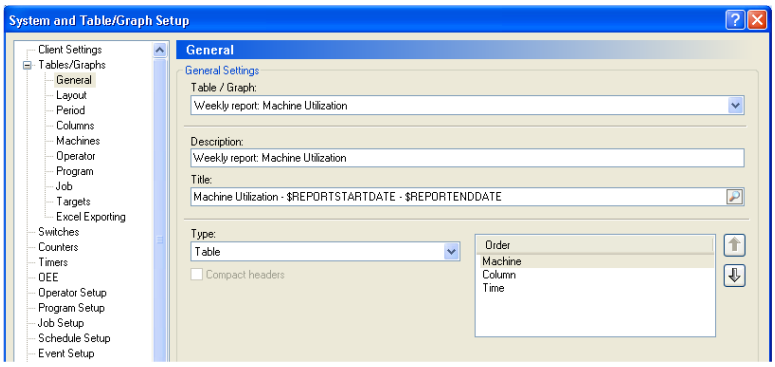
8.8 Machine Utilisation by week and month

First Copy the Daily utilization table as follows:

In System Setup click Tables/Graphs on the left and then highlight Daily Report: Machine utilization then click the Copy button below.

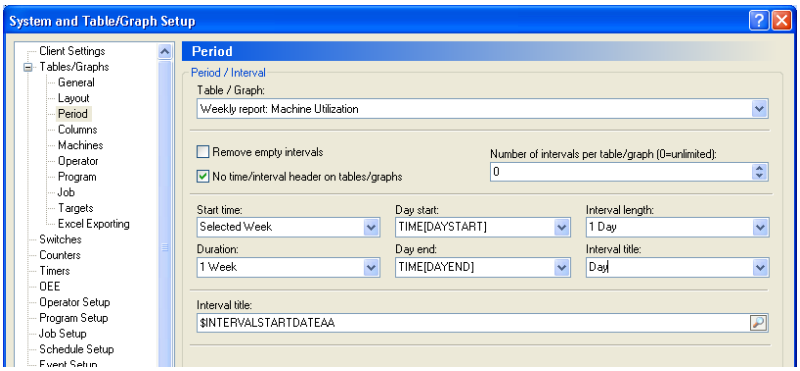


Edit the description to say Weekly report and add - $REPORTENDDATE to the title.



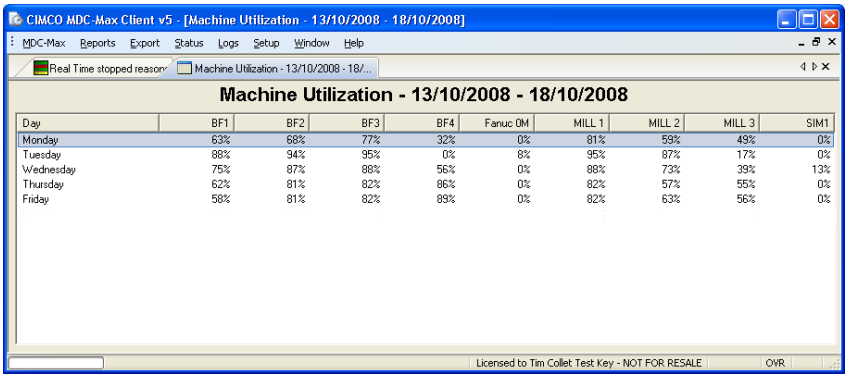
The title of the table will now be of the form “Machine Utilisation – 13/10/2008 – 17/10/2008” which is the start and end date of the selected week.

Click Period on the left and change to the following:



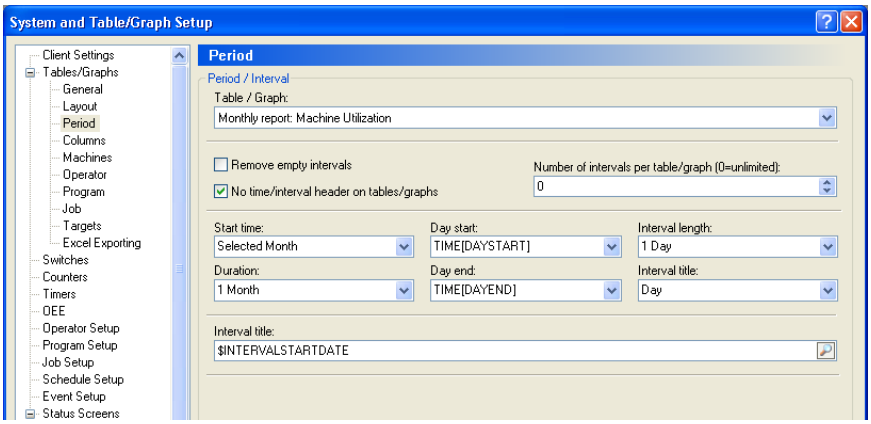
The changes are Start Time Selected week, Duration to 1 week, Interval length to 1 day, Title to Day and interval title to $INTERVALSTARTDATEAA which gives the day of the week.

Click OK to save then generate a table which looks like :



Day	BF1	BF2	BF3	BF4	Fanuc 0M	MILL 1	MILL 2	MILL 3	SIM1
Monday	63%	68%	77%	32%	0%	81%	59%	49%	0%
Tuesday	88%	94%	95%	0%	8%	95%	87%	17%	0%
Wednesday	75%	87%	88%	56%	0%	88%	73%	39%	13%
Thursday	62%	81%	82%	86%	0%	82%	57%	55%	0%
Friday	58%	81%	82%	89%	0%	82%	63%	56%	0%

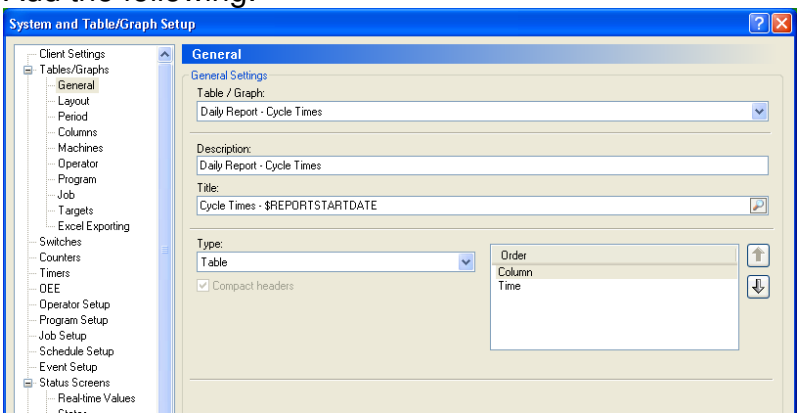
Changing this to monthly is achieved by copying the table again, changing the title to Monthly and setting the period as follows:



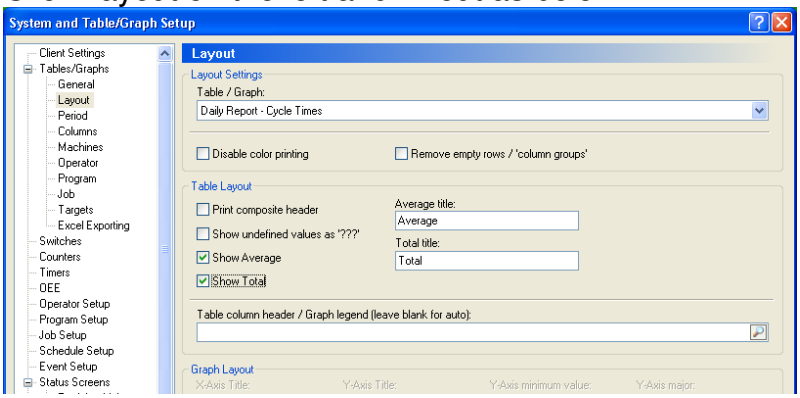
8.9 Cycle times and Cycle Times by job Table Report

Click Setup, System Setup, highlight Tables/Graphs on the left and click the Add button.

Add the following:-

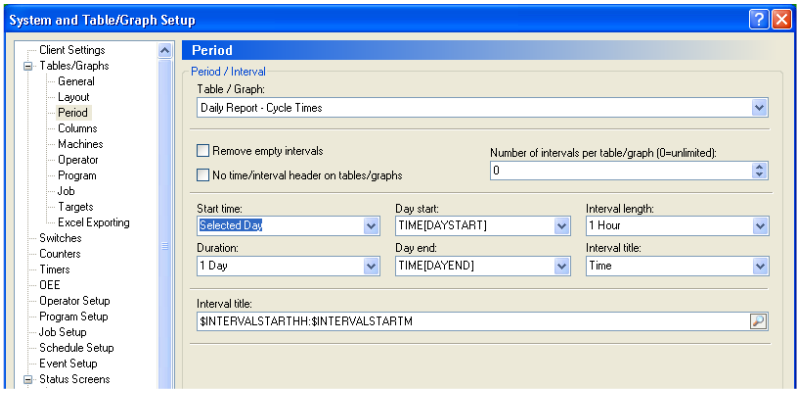


Click Layout on the left and fill out as below:-



Notice here that we have ticked Show Average and Show Total. The average is only really useful if the machine is running the same job continuously. The total will give you the total runtime that day.

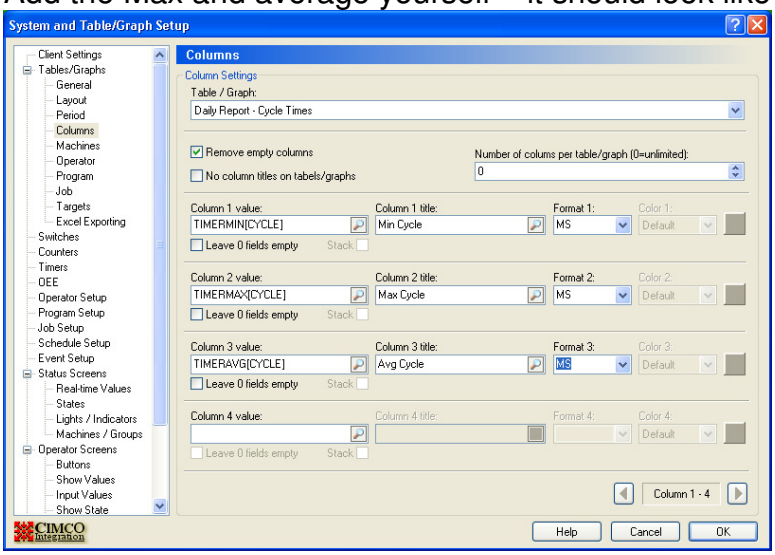
Click Period on the left and fill out as below (this is the same as the Period for the daily machine utilization table).



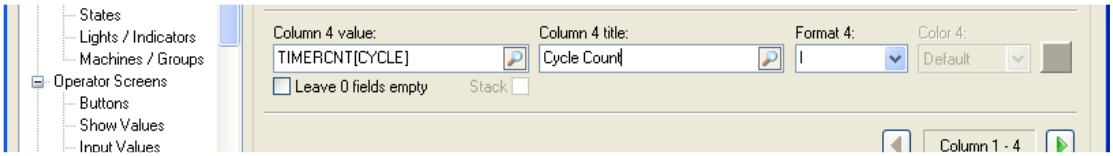
Click Columns on the left. In the machine utilization table we only had one value, for the cycle times it would be useful to have the minimum, maximum and the average cycle time. We will also add the part count to the same table.

Click into Column 1 Value and use the search icon to add TIMERMIN[CYCLE], set the title to Min Cycle and the format to MS.

Add the Max and average yourself – it should look like below:-

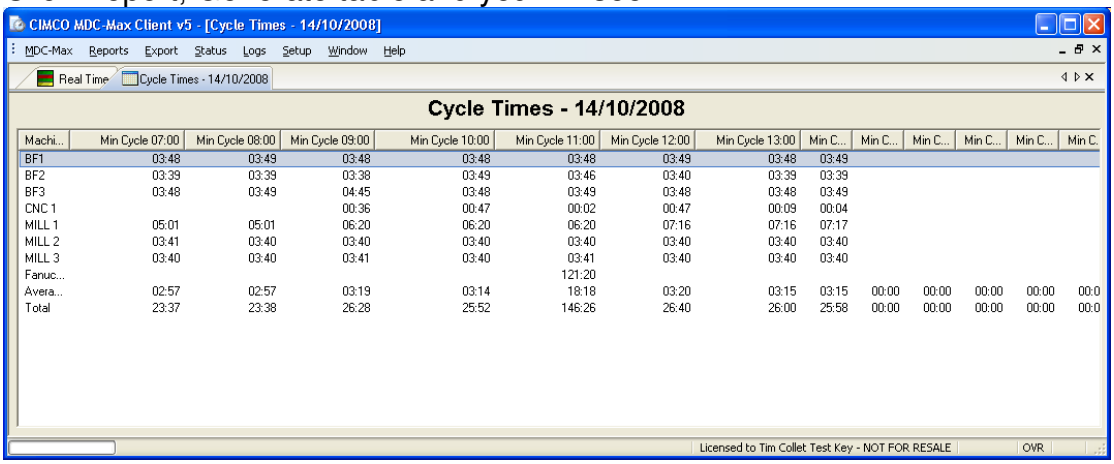


Finally we add the cycle count in column 4 as TIMERCNT[CYCLE], the title as Cycle Count and the format as I (for integer) as below:



Click Machines on the left and tick include machine information and OK the setup.

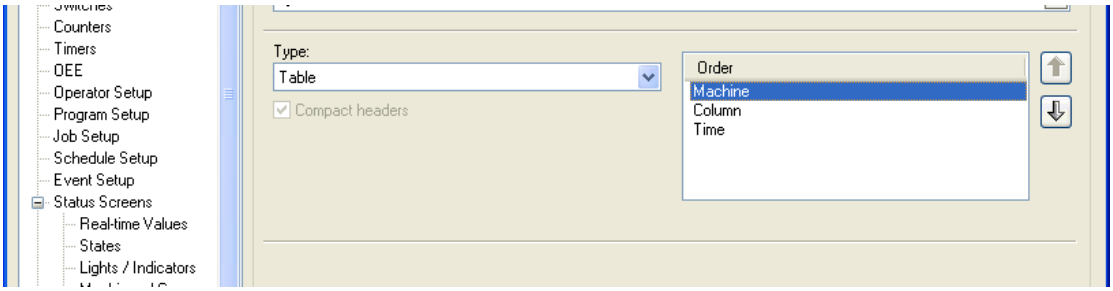
Click Report, Generate table and you will see :-



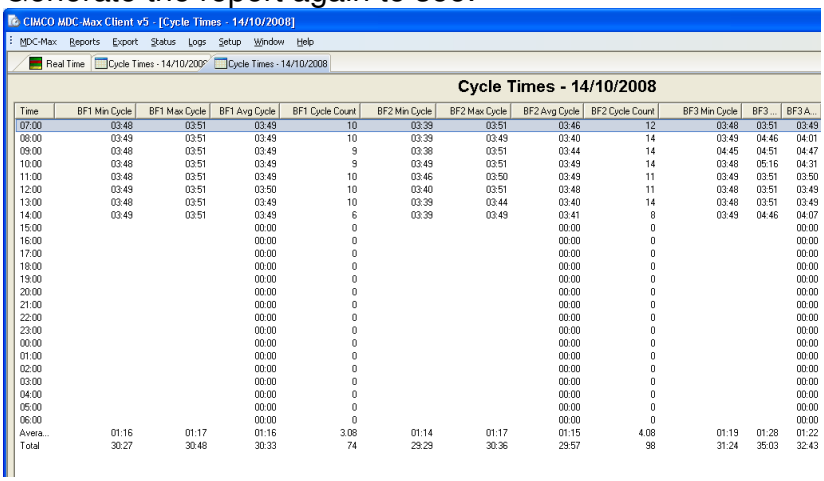
This is not what we want as it gives us an individual column for the first value (Min Cycle) for each time interval, followed by an individual column for the second value (Max Cycle) for each time interval and so on. What we really want is Min, Max, Avg and cycle count for each machine in successive columns.

8.10 Altering the order of items in a Table Report

Edit the table and click General on the left and change the order to Machine, Column, Time using the arrow keys as follows:



Generate the report again to see:-

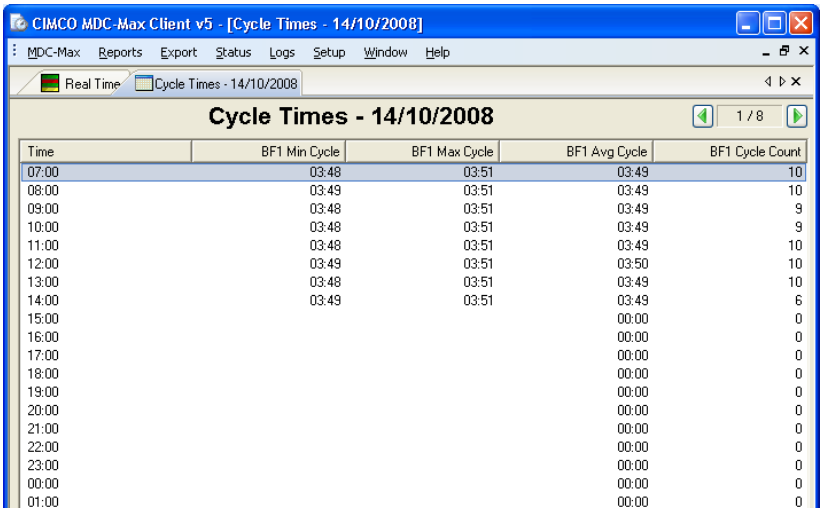


Time	BF1 Min Cycle	BF1 Max Cycle	BF1 Avg Cycle	BF1 Cycle Count	BF2 Min Cycle	BF2 Max Cycle	BF2 Avg Cycle	BF2 Cycle Count	BF3 Min Cycle	BF3 ...	BF3 A...
07:00	03:48	03:51	03:49	10	03:39	03:51	03:46	12	03:48	03:51	03:49
08:00	03:49	03:51	03:49	10	03:39	03:49	03:40	14	03:49	04:46	04:01
09:00	03:48	03:51	03:49	9	03:38	03:51	03:44	14	04:45	04:51	04:47
10:00	03:48	03:51	03:49	9	03:49	03:51	03:49	14	03:48	05:16	04:31
11:00	03:48	03:51	03:49	10	03:46	03:50	03:49	11	03:49	03:51	03:50
12:00	03:49	03:51	03:50	10	03:40	03:51	03:48	11	03:48	03:51	03:49
13:00	03:48	03:51	03:49	10	03:39	03:44	03:40	14	03:48	03:51	03:49
14:00	03:49	03:51	03:49	6	03:39	03:49	03:41	8	03:49	04:46	04:07
15:00			00:00	0			00:00	0			00:00
16:00			00:00	0			00:00	0			00:00
17:00			00:00	0			00:00	0			00:00
18:00			00:00	0			00:00	0			00:00
19:00			00:00	0			00:00	0			00:00
20:00			00:00	0			00:00	0			00:00
21:00			00:00	0			00:00	0			00:00
22:00			00:00	0			00:00	0			00:00
23:00			00:00	0			00:00	0			00:00
00:00			00:00	0			00:00	0			00:00
01:00			00:00	0			00:00	0			00:00
02:00			00:00	0			00:00	0			00:00
03:00			00:00	0			00:00	0			00:00
04:00			00:00	0			00:00	0			00:00
05:00			00:00	0			00:00	0			00:00
06:00			00:00	0			00:00	0			00:00
Avera...	01:16	01:17	01:16	3.08	01:14	01:17	01:15	4.08	01:19	01:28	01:22
Total	30:27	30:48	30:33	74	29:29	30:36	29:57	98	31:24	35:03	32:43

Notice now that we now have each column value in turn (Min, Max Avg, Count) for the first machine, followed by the next machine and so on.

8.11 Creating a separate table for each machine

Edit the table, click Machines on the left and set the number of machines per table to 1 and re-generate the table as below

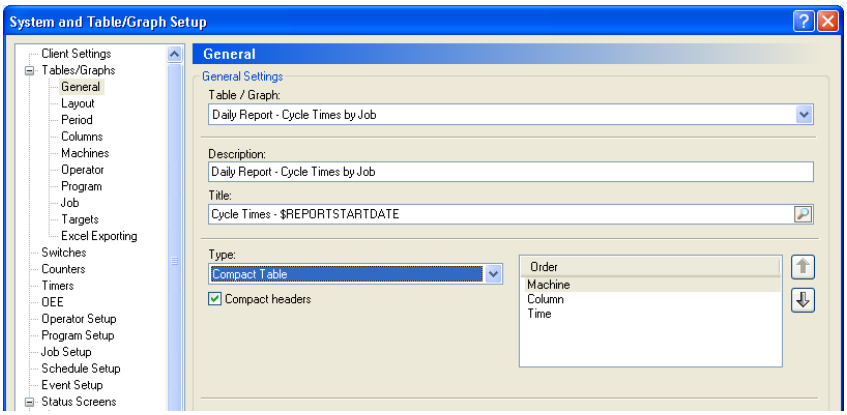


Time	BF1 Min Cycle	BF1 Max Cycle	BF1 Avg Cycle	BF1 Cycle Count
07:00	03:48	03:51	03:49	10
08:00	03:49	03:51	03:49	10
09:00	03:48	03:51	03:49	9
10:00	03:48	03:51	03:49	9
11:00	03:48	03:51	03:49	10
12:00	03:49	03:51	03:50	10
13:00	03:48	03:51	03:49	10
14:00	03:49	03:51	03:49	6
15:00			00:00	0
16:00			00:00	0
17:00			00:00	0
18:00			00:00	0
19:00			00:00	0
20:00			00:00	0
21:00			00:00	0
22:00			00:00	0
23:00			00:00	0
00:00			00:00	0
01:00			00:00	0

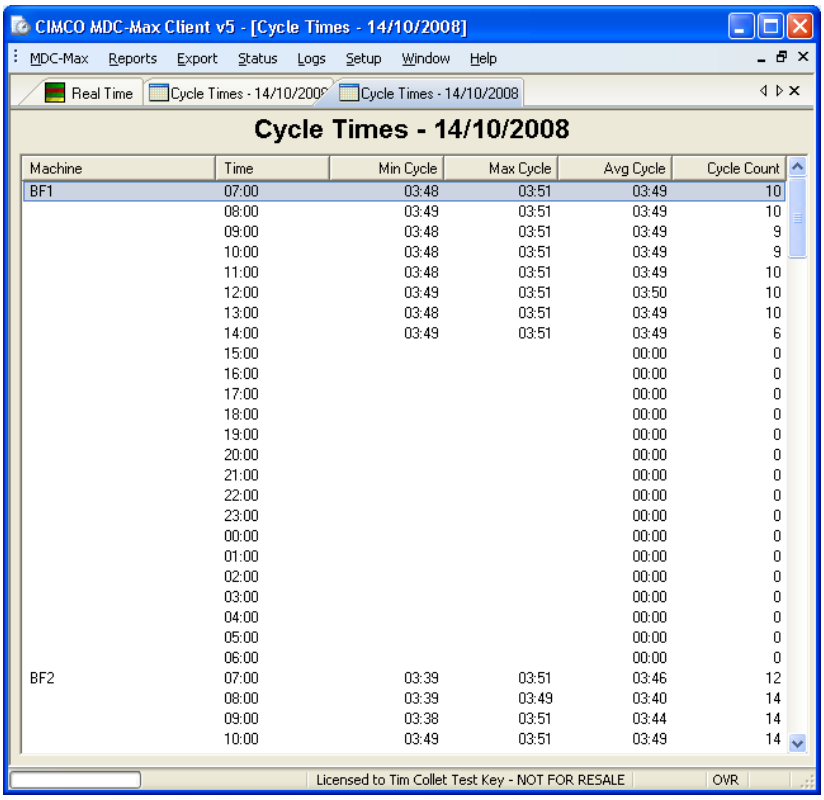
Now we have a have an individual table for each machine with the average and total. Wherever there is an empty space in the table it means the machine was not running.

8.12 Adding Jobname info to Cycle times Tables

Copy the existing Daily Report - Cycle Times Table and call it Daily Report – Cycle Times by Job. Change the Table type to Compact Table – this enables us to display more information in a single table.



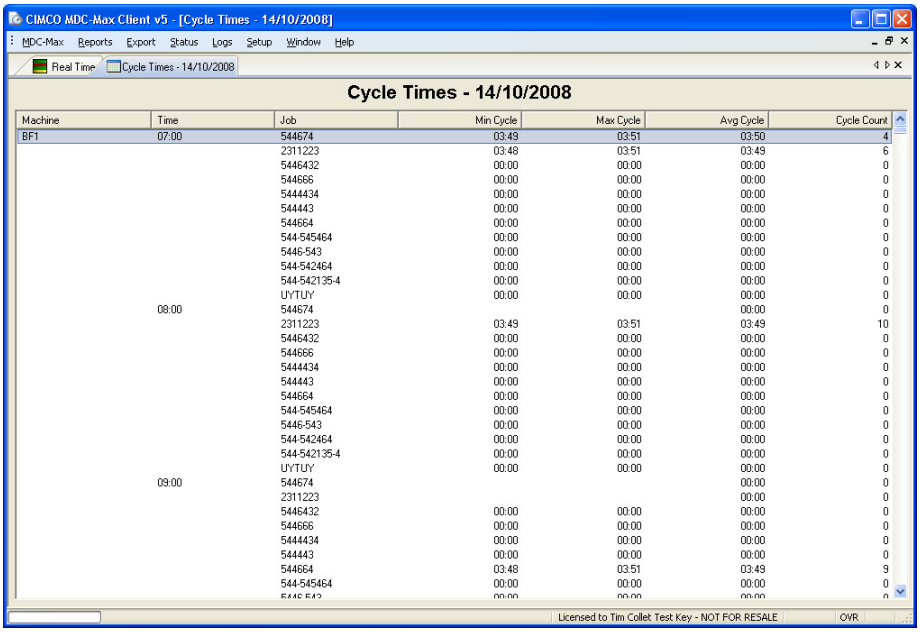
Before we add the job information click Machines on the left and set the number of machines per table back to 0 and generate the table. See how it looks now :



Notice now that the machine appears in the table contents itself (machine 1 followed by machine two down the table) and the other columns are the same

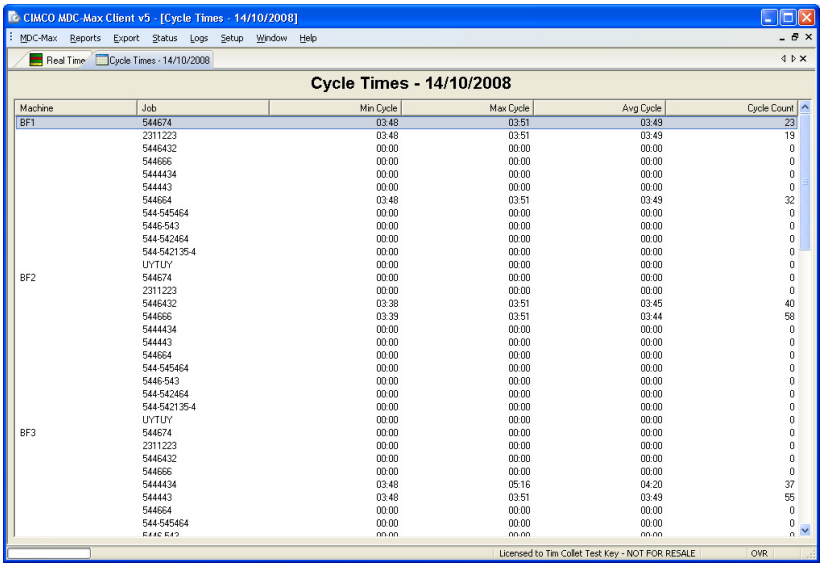
as before. This format is useful if you want to export the data to an Excel spreadsheet (see section 8.14).

Now we need to add the job information to the table, edit the table and click Job on the left and then tick include job information. Generate the table and it will look like below:-



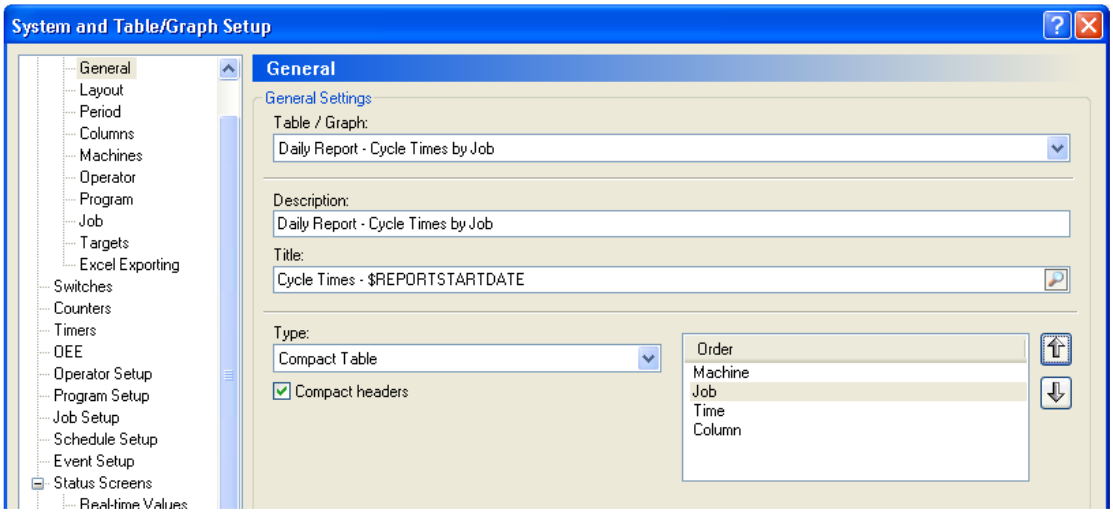
The machine is listed first then the time (1 hour intervals) then the job. So we get one entry for each 1 hour interval per job. We would rather see 1 entry per machine per job per day.

Edit the table and click Period on the left. Change the Interval Length to 1 day and tick the No time interval header on table (we don't need a separate column for the time interval at the moment as the table will only be for one day). Generate the table and it will look like below :-

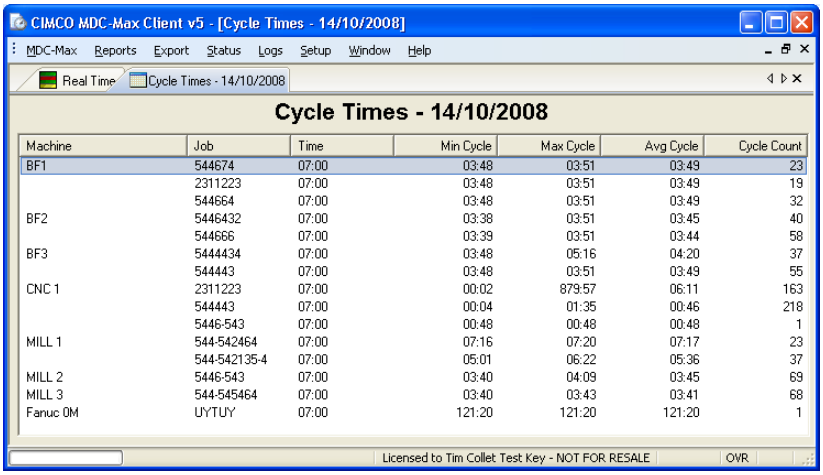


Now we have machine followed by job and the Min, Max etc. but notice that there is one entry per job for each machine regardless of whether that job ran

on the machine. To fix this we must change the order of the columns in the table. Edit the table click General on the left and modify the order as follows :

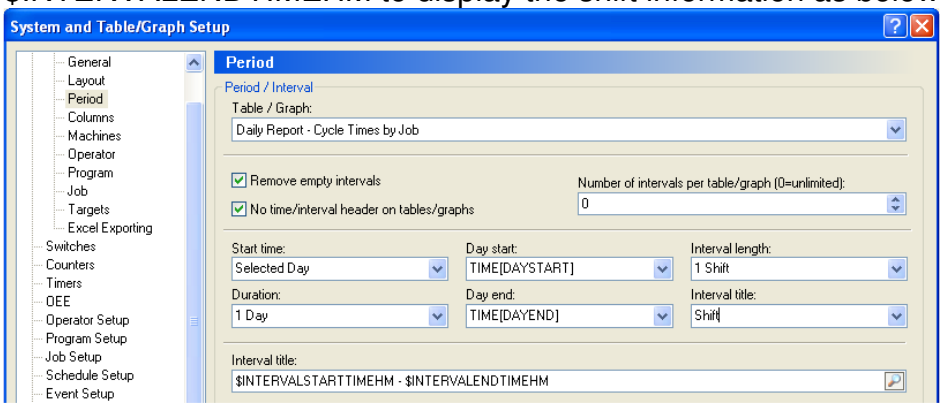


Click Period on the left and tick Remove Empty intervals and No time interval on table. Click OK and generate the table and you will get:

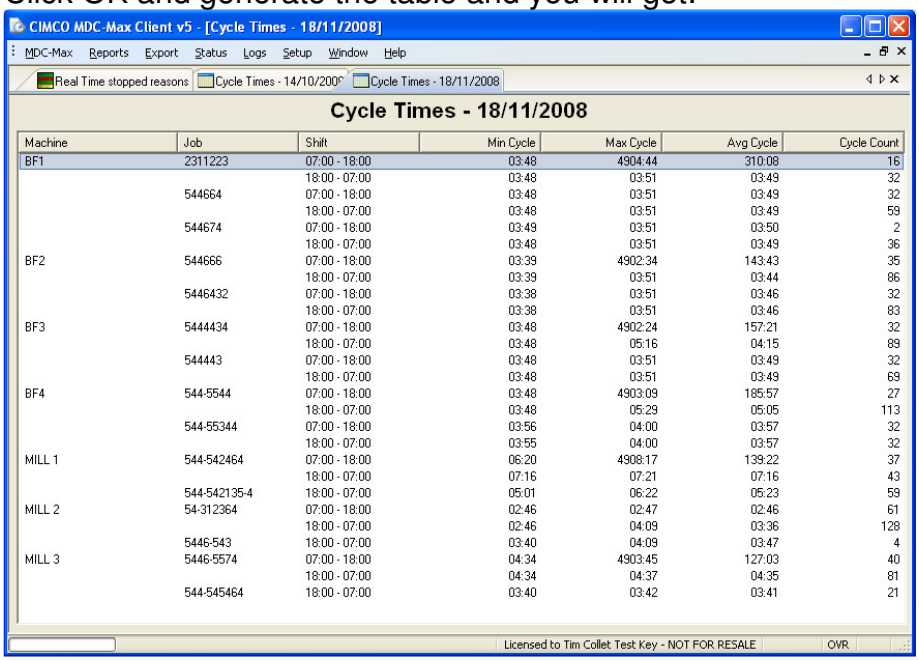


8.13 Adding Shift Information to Cycle times Tables

We can further refine this to display the shifts separately. Click Period on the left and select an interval length of 1 shift and edit the Interval title to say Shift, the interval title should be set to $INTERVALSTARTTIMEHM - $INTERVALENDTIMEHM to display the shift information as below



Click OK and generate the table and you will get:-



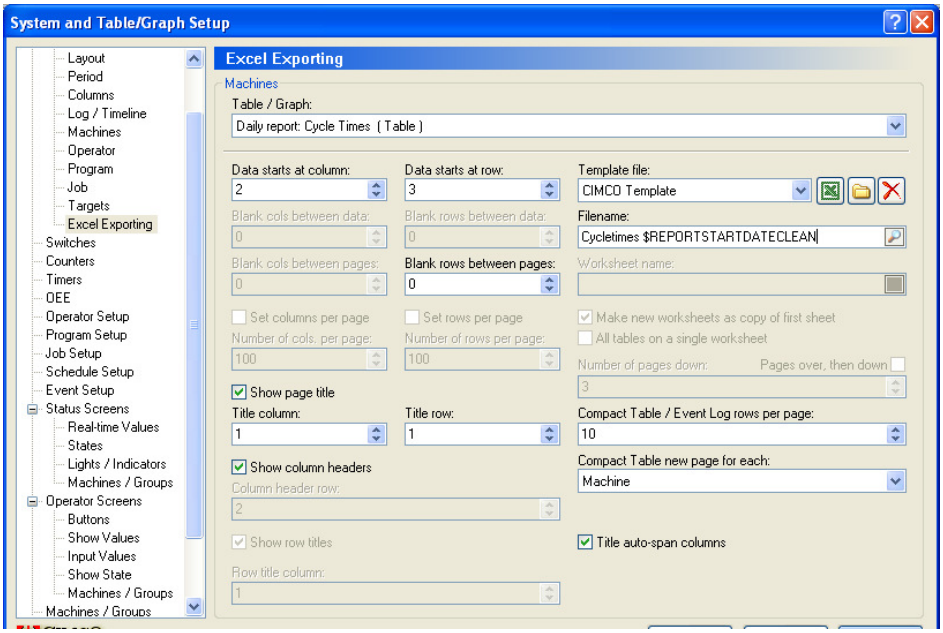
Machine	Job	Shift	Min Cycle	Max Cycle	Avg Cycle	Cycle Count
BF1	2311223	07:00 - 18:00	03:48	4904:44	310:08	16
		18:00 - 07:00	03:48	03:51	03:49	32
	544664	07:00 - 18:00	03:48	03:51	03:49	32
		18:00 - 07:00	03:48	03:51	03:49	59
	544674	07:00 - 18:00	03:49	03:51	03:50	2
		18:00 - 07:00	03:48	03:51	03:49	36
BF2	544666	07:00 - 18:00	03:39	4902:34	143:43	35
		18:00 - 07:00	03:39	03:51	03:44	86
	5446432	07:00 - 18:00	03:38	03:51	03:46	32
		18:00 - 07:00	03:38	03:51	03:46	83
BF3	5444434	07:00 - 18:00	03:48	4902:24	157:21	32
		18:00 - 07:00	03:48	05:16	04:15	89
	544443	07:00 - 18:00	03:48	03:51	03:49	32
		18:00 - 07:00	03:48	03:51	03:49	69
BF4	544-5544	07:00 - 18:00	03:48	4903:09	185:57	27
		18:00 - 07:00	03:48	05:29	05:05	113
	544-55344	07:00 - 18:00	03:56	04:00	03:57	32
		18:00 - 07:00	03:55	04:00	03:57	32
MILL 1	544-542464	07:00 - 18:00	06:20	4908:17	139:22	37
		18:00 - 07:00	07:16	07:21	07:16	43
	544-542135-4	18:00 - 07:00	05:01	06:22	05:23	59
MILL 2	54-312364	07:00 - 18:00	02:46	02:47	02:46	61
		18:00 - 07:00	02:46	04:09	03:36	128
	5446-543	18:00 - 07:00	03:40	04:09	03:47	4
MILL 3	5446-5574	07:00 - 18:00	04:34	4903:45	127:03	40
		18:00 - 07:00	04:34	04:37	04:35	81
	544-545464	18:00 - 07:00	03:40	03:42	03:41	21

This is exactly what we want – a table showing the jobs run on each machine with the cycle times for those jobs for each shift.

8.14 Exporting a Table Report into Excel

The values on any table can be exported into an excel spreadsheet for further analysis. This will enable the end user to generate reports based on their own Excel template.

This is configured in the Excel Exporting section of the table setup.



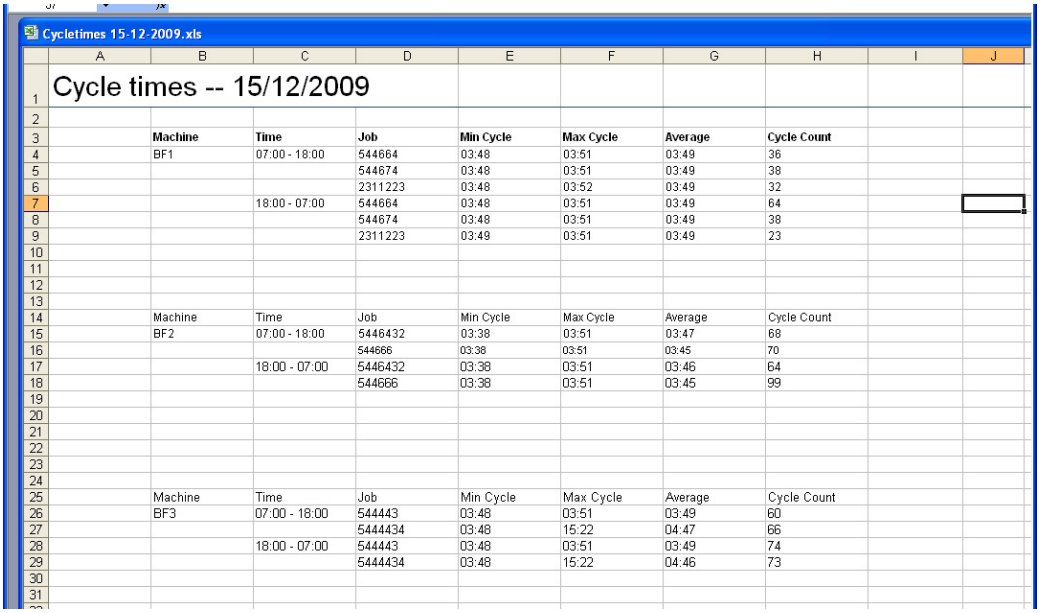
Choose the table to export from the drop down box and then click the Browse button next to the 'Template File' to select the customer's spreadsheet template file (or one you have already created in Excel for them). Store the template on a network share that every client has access to and use a UNC name (\\servername\sharename\filename) rather than a mapped drive (F:\filename) as each MDC-Max client must be able to access the spreadsheet.

The template may be a simple spreadsheet or a highly customised one using macro's to generate complex graphs and tables from the information that MDC-Max inserts.

MDC-Max will create a use the template to create a new spreadsheet and you put this filename into the 'Filename' box. In the example above the name of the file is 'Cycletimes $REPORTSTARTDATECLEAN'. This generates a new file each day (if the report is a daily report) of the form :-
Cycletimes 15-12-2009.xls (see the sample below)

$REPORTSTARTDATECLEAN is a system variable that gives a date in the form "12-12-2010" so we don't get extra "/" characters in the filename.

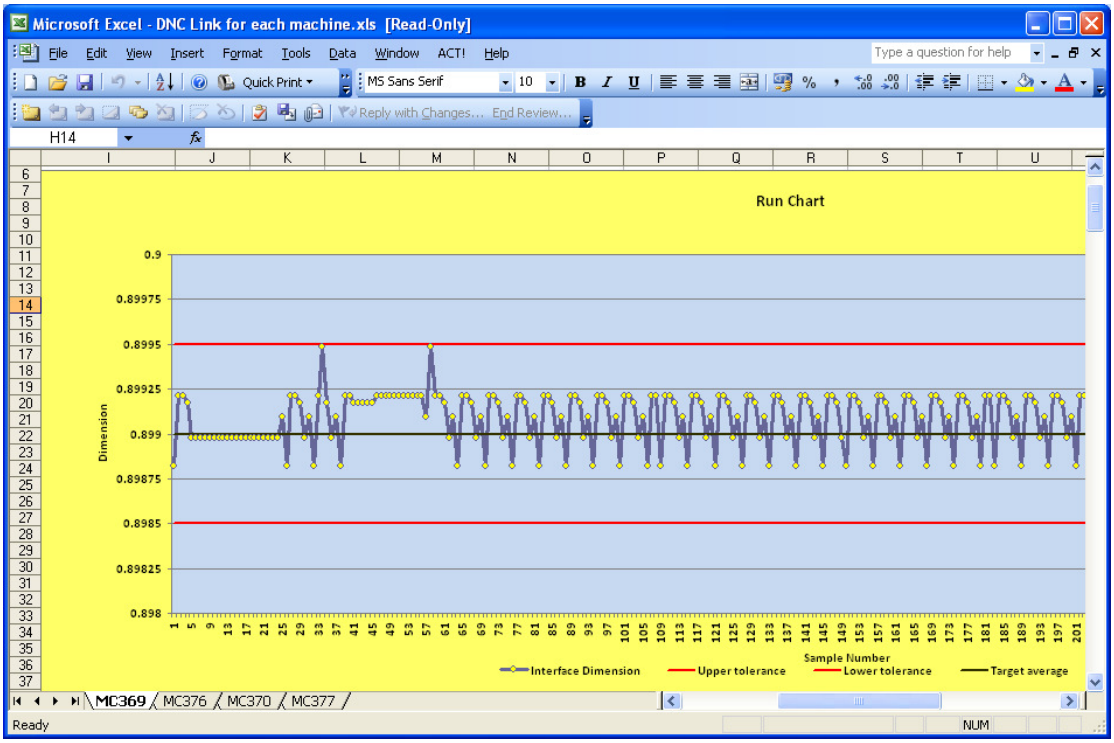
The 'Data starts at column' and 'Data starts at Row' boxes determine where the table will be inserted in the spreadsheet.



Cycletimes 15-12-2009.xls

	A	B	C	D	E	F	G	H	I	J
1	Cycle times -- 15/12/2009									
2										
3		**Machine**	**Time**	**Job**	**Min Cycle**	**Max Cycle**	**Average**	**Cycle Count**		
4		BF1	07:00 - 18:00	544664	03:48	03:51	03:49	36		
5				544674	03:48	03:51	03:49	38		
6				2311223	03:48	03:52	03:49	32		
7			18:00 - 07:00	544664	03:48	03:51	03:49	64		
8				544674	03:48	03:51	03:49	38		
9				2311223	03:49	03:51	03:49	23		
10										
11										
12										
13										
14		Machine	Time	Job	Min Cycle	Max Cycle	Average	Cycle Count		
15		BF2	07:00 - 18:00	5446432	03:38	03:51	03:47	68		
16				544666	03:38	03:51	03:45	70		
17			18:00 - 07:00	5446432	03:38	03:51	03:46	64		
18				544666	03:38	03:51	03:45	99		
19										
20										
21										
22										
23										
24										
25		Machine	Time	Job	Min Cycle	Max Cycle	Average	Cycle Count		
26		BF3	07:00 - 18:00	544443	03:48	03:51	03:49	60		
27				5444434	03:48	15:22	04:47	66		
28			18:00 - 07:00	544443	03:48	03:51	03:49	74		
29				5444434	03:48	15:22	04:46	73		
30										
31										

It is not always possible to know how much data you are going to generate so it is useful to create a spreadsheet template file with two sheets and reserve the first sheet for the MDC-Max table data. The second sheet can then be used for the graphs which are generated from the data as follows :-



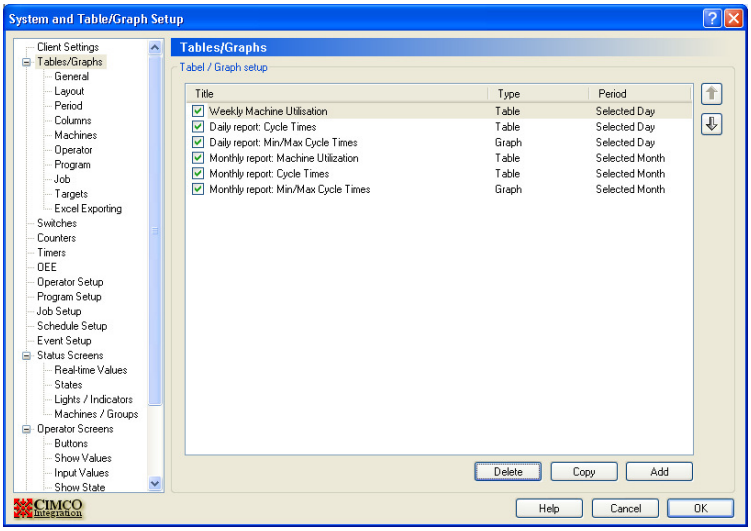
You can expand this method to generate a separate sheet for each machine with a chart alongside the data if you wish.

Chapter 9 – Graph Reports in MDC-Max

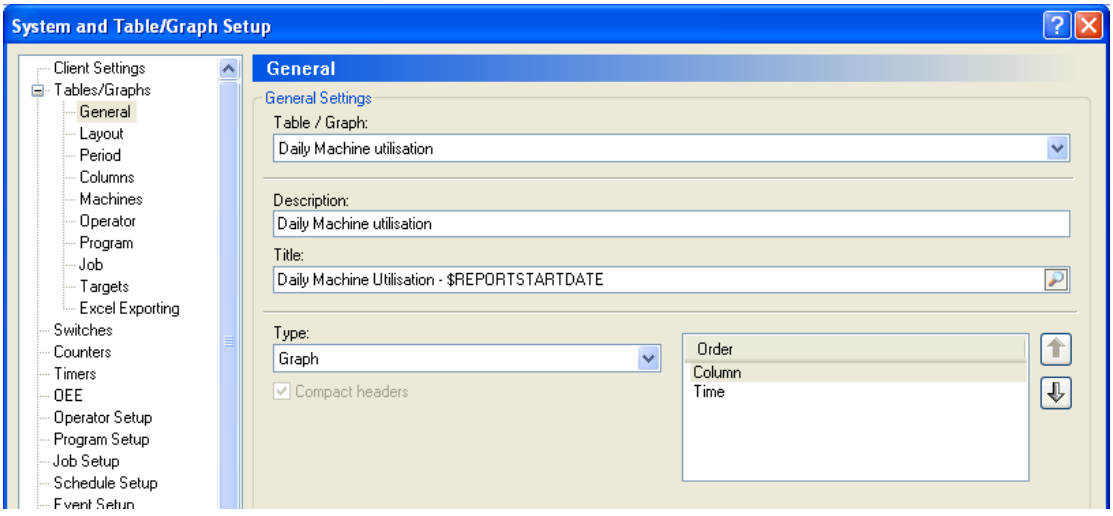
A Graph is a bar chart of data for each machine such as run time today, machine efficiency today, stopped time by reason code and so on.

9.1 Machine Utilisation Bar Chart

For our first Graph we will create a simple machine utilisation graph.
On the main MDC-Max screen click Setup, System Setup then click on the 'Tables/Graphs' link on the left.



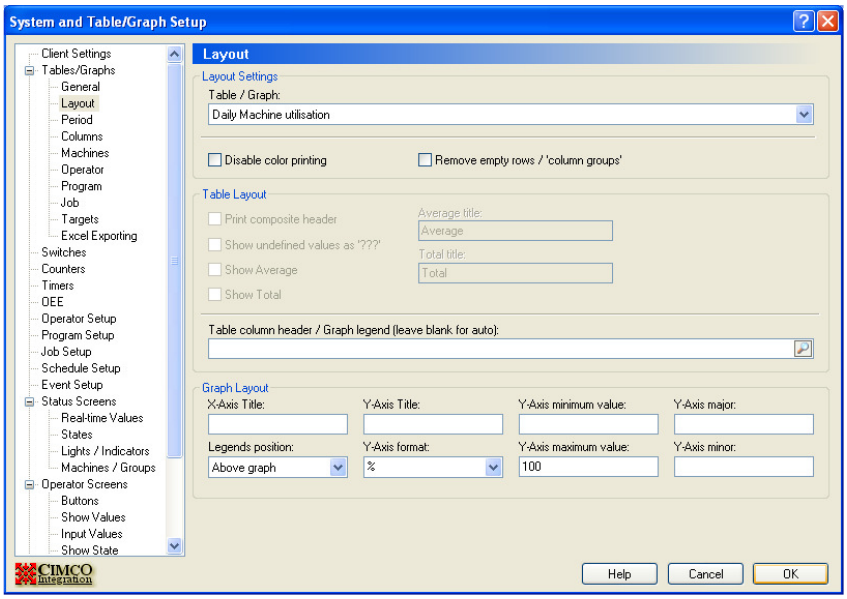
Click the Add button to see the screen below and type a description in the Description field – this is the name of the graph. Type a title in the Title field – this is what is displayed on the actual Graph in this case the $REPORTSTARTDATE will display the date on the top of the graph.



9.2 Formatting the Graph Report

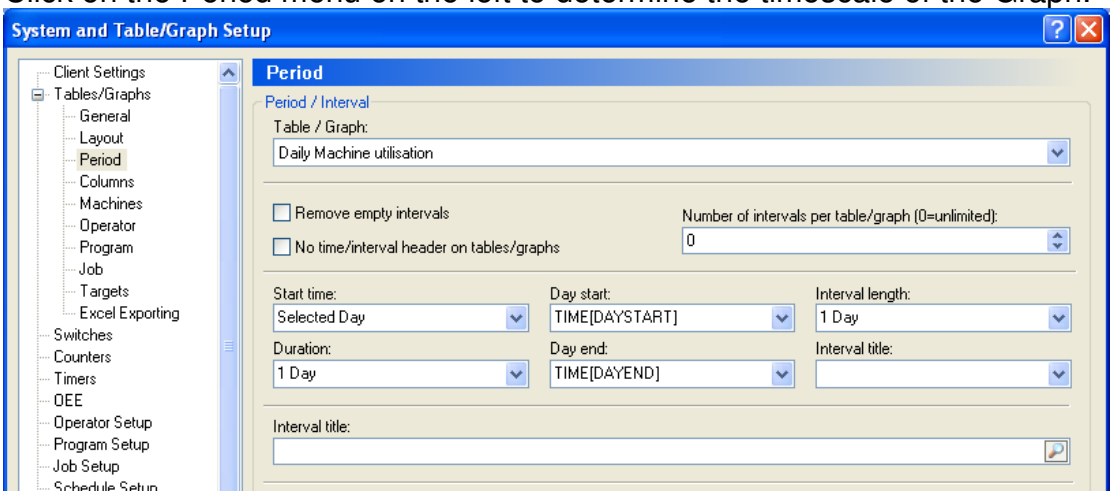
The type must be set to Graph – this produces a bar chart.

Click on the Layout menu on the left of the screen and the layout page will appear



The layout determines how the data will be laid out on the graph. For our simple utilization graph we leave the graph legend blank, set the Legends position to 'Above Graph' set the Y-\Axis format to % and set the Y-axis maximum value to 100. This will display the utilization as a percentage with 100% as the maximum value on the graph. Each column in our graph will then be named by machine name.

Click on the Period menu on the left to determine the timescale of the Graph.



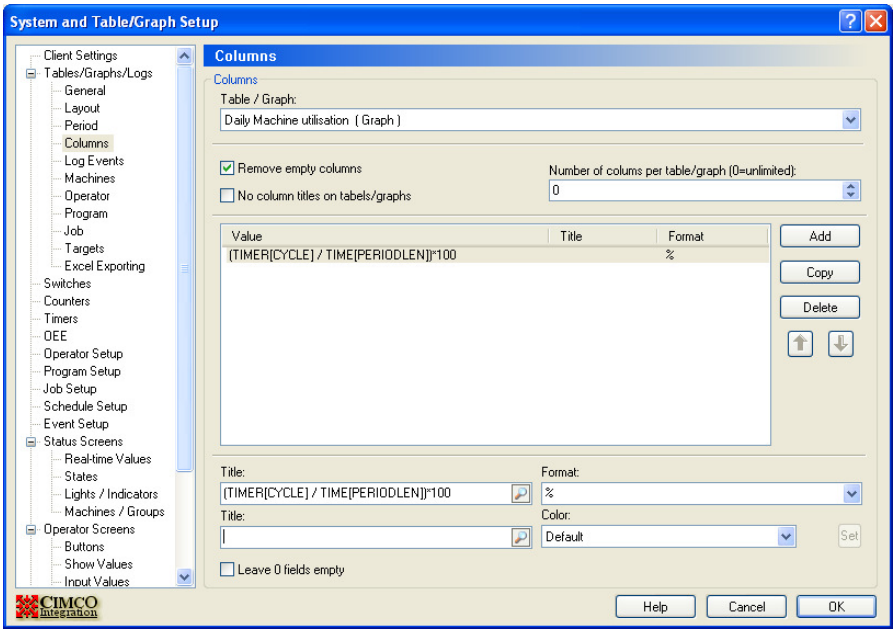
"Start Time" and "Duration" determine the total period of the Graph. Selected Day means that when we run the graph the user will be able to select a day from a calendar. We want to report on a single day so the duration is 1 day.

The interval length determines how many rows of data will be generated for each machine per day. If we set this to 1 Day then we will get a row per machine for the total utilization for that day. The “Day Start” field is set to TIME[DAYSTART] – this means the graph will start at the beginning of the first shift.
The “Day End” is set to TIME[DAYEND] so the graph ends at the end of the final shift.

If your first shift starts at 6 am and you run three shifts ending at 6 the next morning, the graph above will run from 6 to 6, not from Midnight to Midnight.

9.3 Adding Data to a Graph Report

Click on the Columns menu on the left to determine what values are displayed



Each graph can display multiple columns of data per machine but in this example we only want the utilization as a percentage. Click into the first Title value and then use the search icon to select TIMER[CYCLE]. This would give us the actual run time in minutes and seconds in that hour.

What we actually want is the percentage runtime for the whole day so we must enter a formula to give us this. The formula we want is :
(TIMER[CYCLE] / TIME[PERIODLEN])*100
Ie divide the actual runtime by the interval time (1 day) and then multiply by 100 to get a percentage. Always use TIME[PERIODLEN] for the total time in any interval – then if you change the interval to 15M or 1 Day the formula will still work.

Use the search icon to edit the Title value and then scroll to the bottom of values to find TIME[PERIODLEN] and double click to add this into the formula and then type the brackets and the *100.

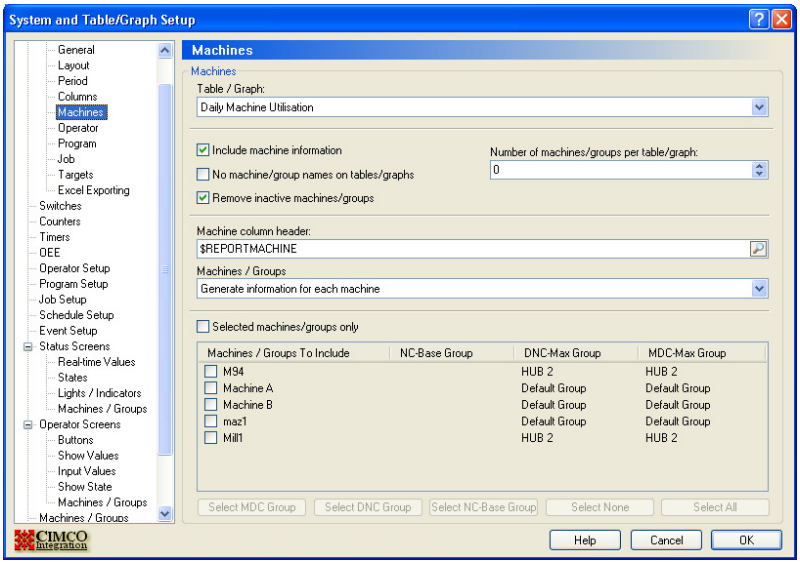
The Format determines how the data is to be displayed (the drop down menu icon gives a series of valid formats) in this case we use % to display a percentage.

TIMERCNT[CYCLE] to give a part count (format I for integer)

Ticking the No Column Titles on Graphs/graphs cleans up the graph display

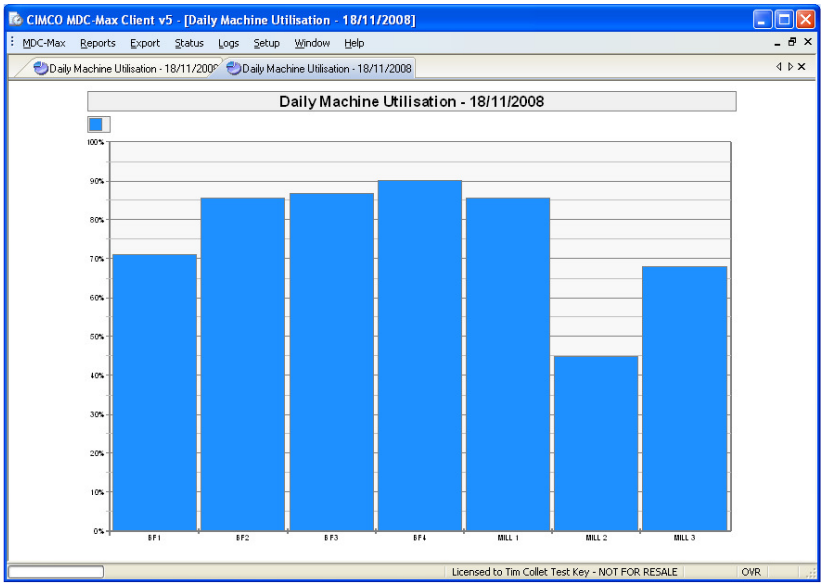
9.4 Adding Machine Information to a Graph Report

Finally click the Machines menu on the left to edit machine info.
This page determines how the data is displayed by machine and what machines to include.

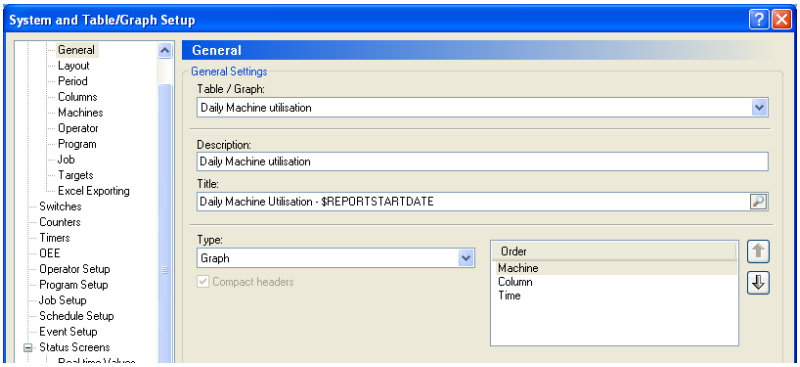


Tick the “Include machine information” field and this will break the graph into individual machine totals.
The “Number of machines/groups per graph/graph” field determines how many machines will be displayed on each page. If you have a large number of machines, set this to 8 and you will only get 8 machines per graph.
Ticking “Remove inactive machines/groups” stops the graph displaying empty columns for inactive machines where there is always zero utilisation.
The ‘Machine column header’ determines what is displayed at the top of each column.

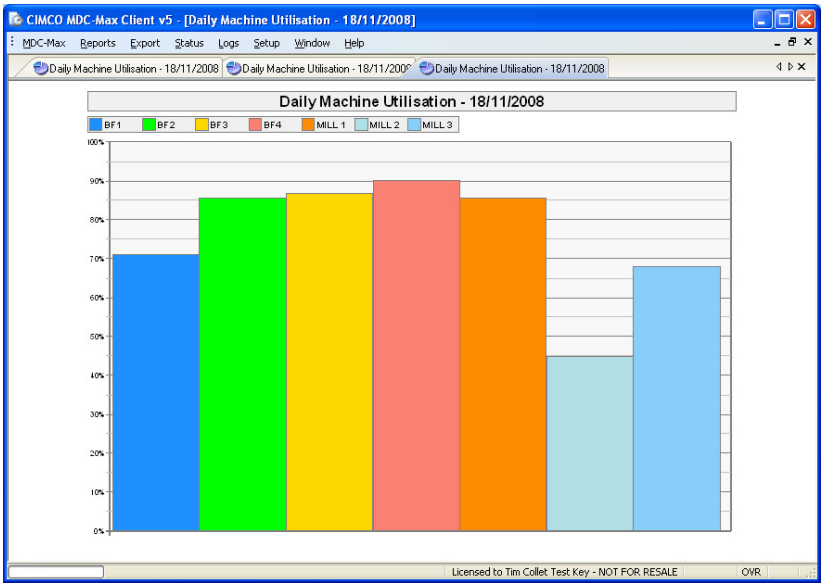
Here is the chart generated by the settings in our screen shots:



This has the machine names across the bottom of the graph. This can be further refined by going to the general menu and changing the Order to put the machines first as below.

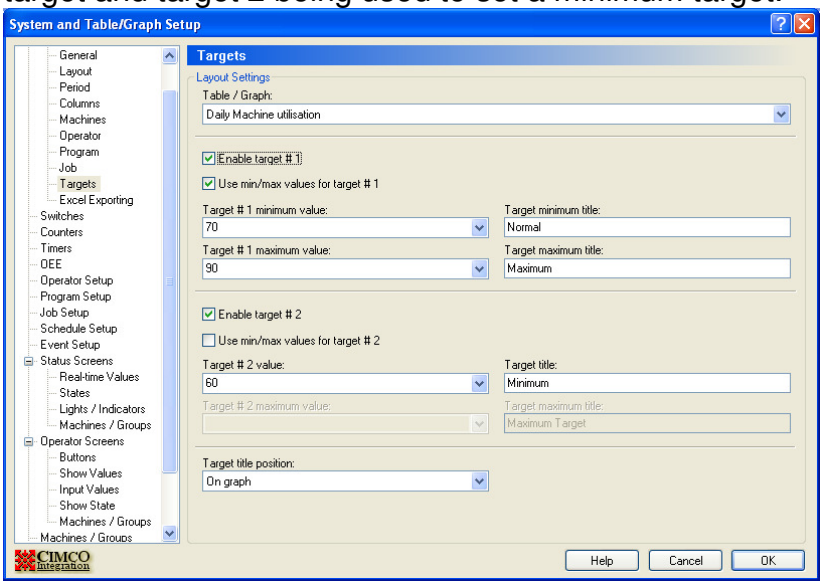


This then produces a graph with the machine names on a colour coded legend

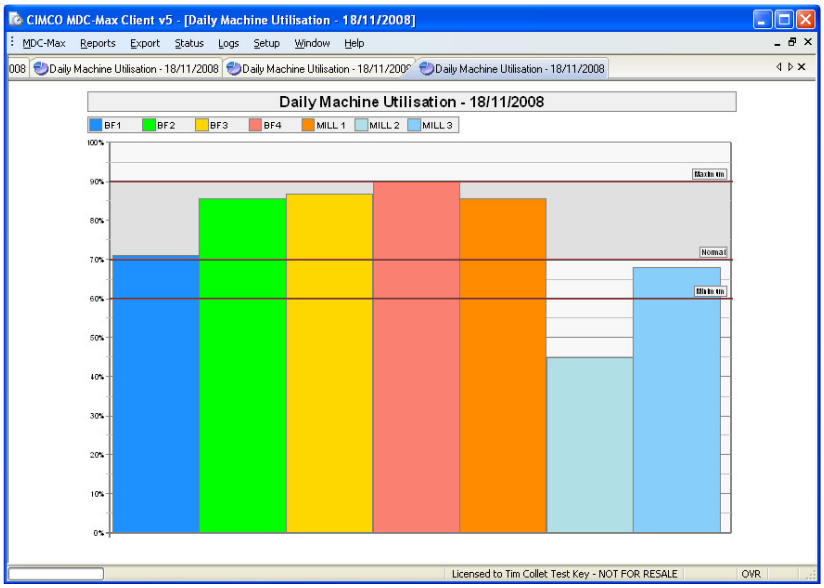


9.5 Adding Targets to Graph Reports

Since these graphs will often be used for motivational purposes, targets can be added to the graphs. Edit the graph report and click Targets on the left. The example below shows target 1 being used to set a normal and maximum target and target 2 being used to set a minimum target.



The resultant graph shows the following.

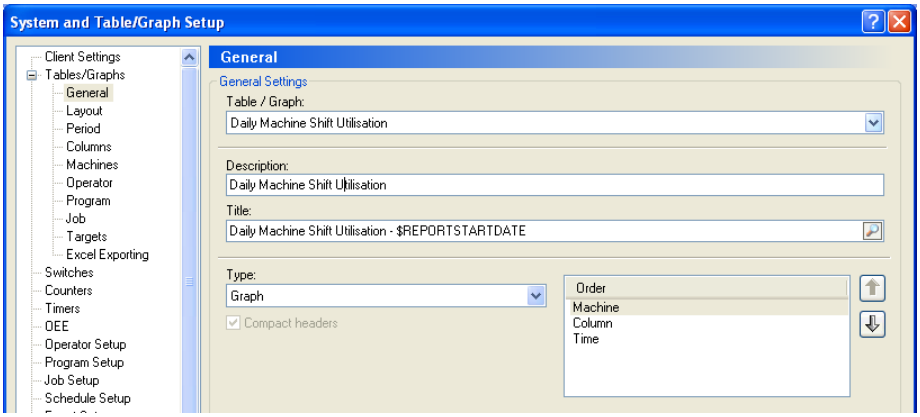


The Target1 settings have produced the Maximum and Normal lines on the graph and the grey area between them. The Target2 settings have produced the minimum line.

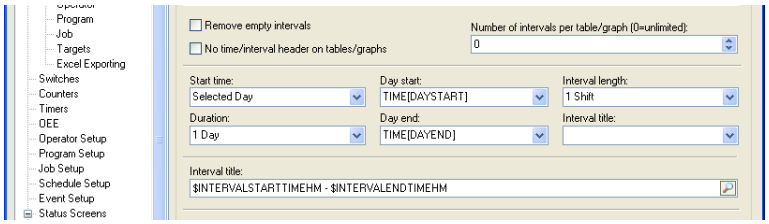
9.6 Adding Shift Information to Graph Reports

If a graph of utilisation on a shift basis is required it will be necessary to produce a different type of graph. Normally this can be done by copying an existing graph and modifying it.

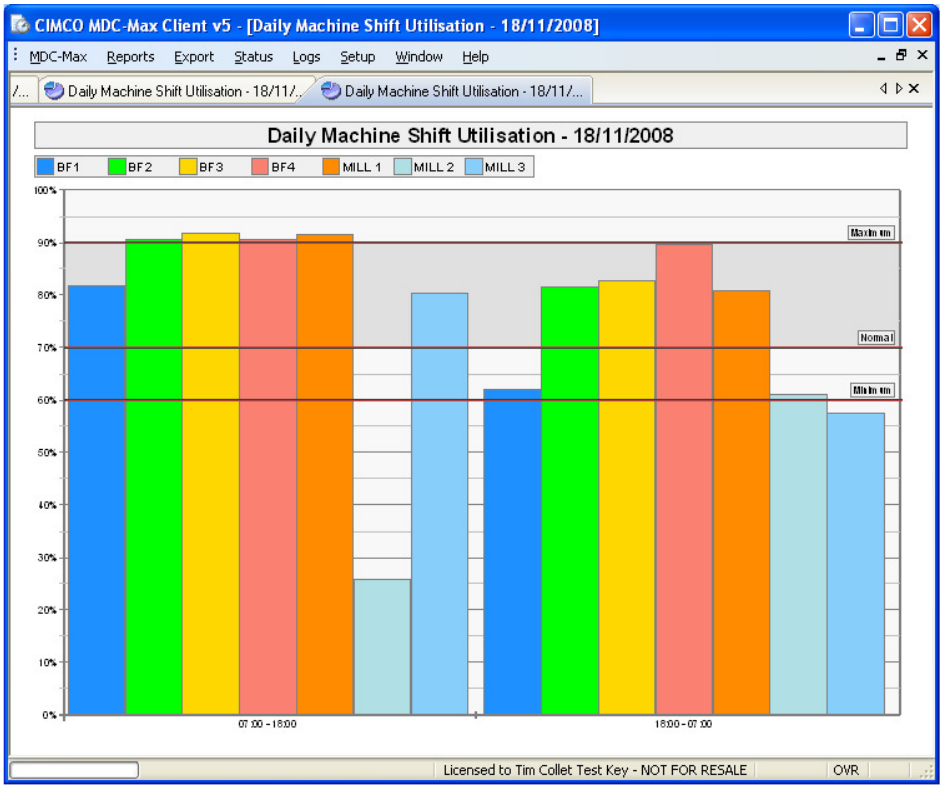
Go to the main Graphs/Graphs menu, select the graph we have just created and click the COPY button.



Edit the Description and Title to indicate this will be per Shift graph
Go to the Period menu and edit the interval length to '1 Shift' and edit the Interval Title to $INTERVALSTARTTIMEHM - $INTERVALENDTIMEHM



The resulting graph should look like the following.

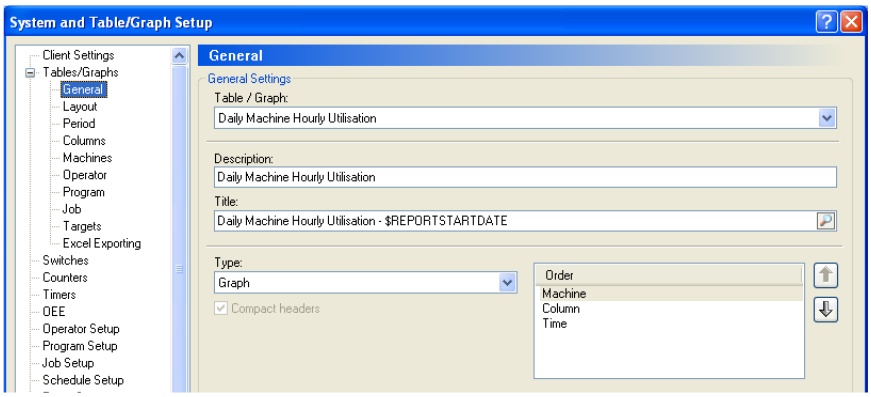


With a separate set of columns for each shift (we are running a two shift system in this example).

9.7 Creating one Graph per machine

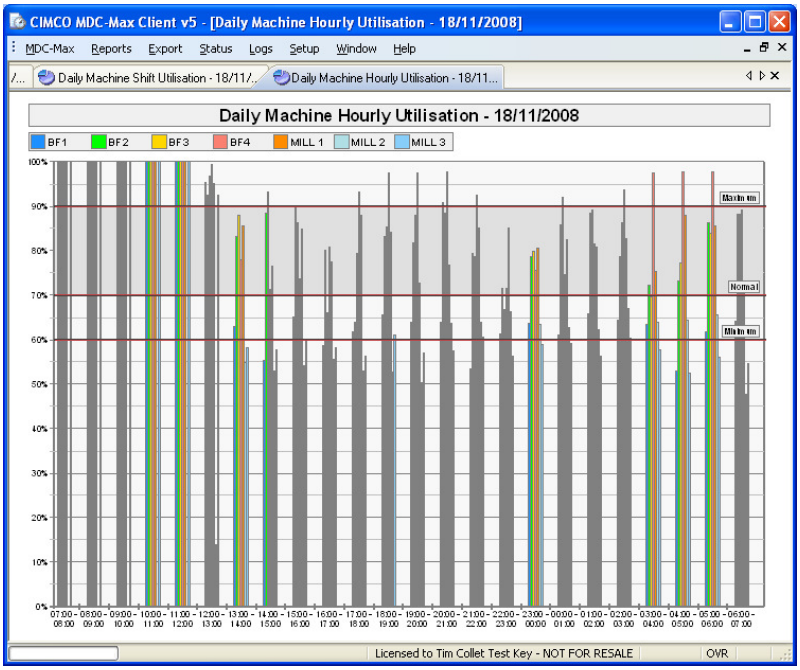
To separate the graph into smaller time intervals it is normally necessary to produce one graph per machine.

To do this go to the main Graphs/Graphs menu, select the graph we have just created and click the COPY button.

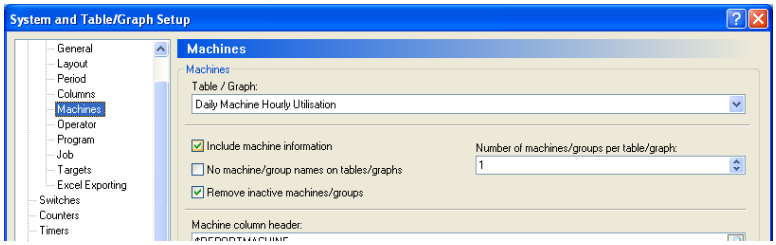


Edit the Description and Title to indicate this will be an hourly graph

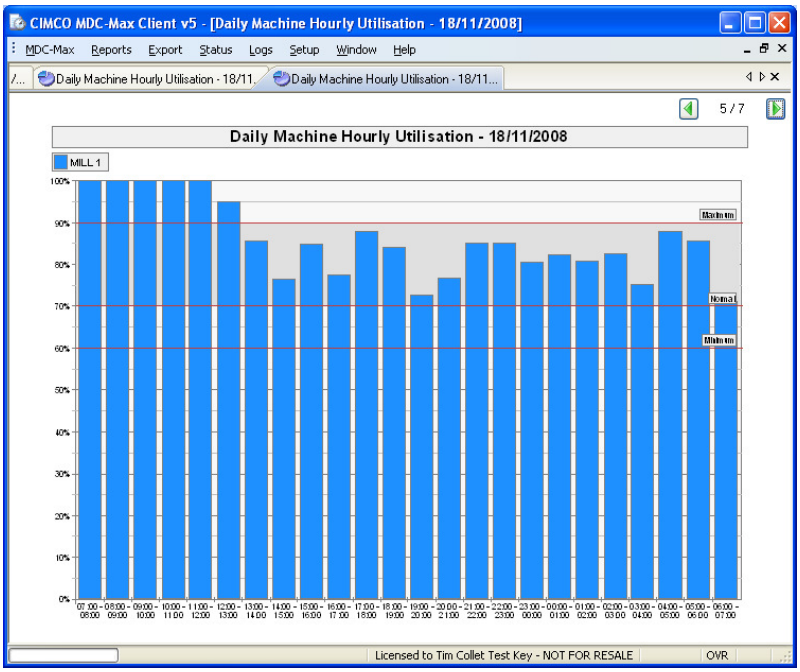
Go to the Period menu and edit the interval length to '1 Hour' and check the Interval Title is set to $INTERVALSTARTTIMEHM - $INTERVALENDTIMEHM as before. The resulting graph will now look unreadable as per the graph below.



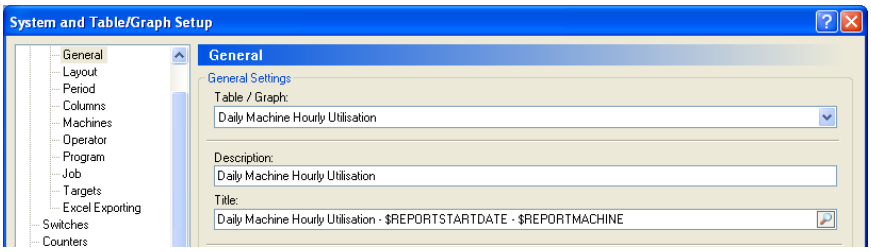
Now go to the machines menu and change the 'Number of machines/groups per table/graph to 1



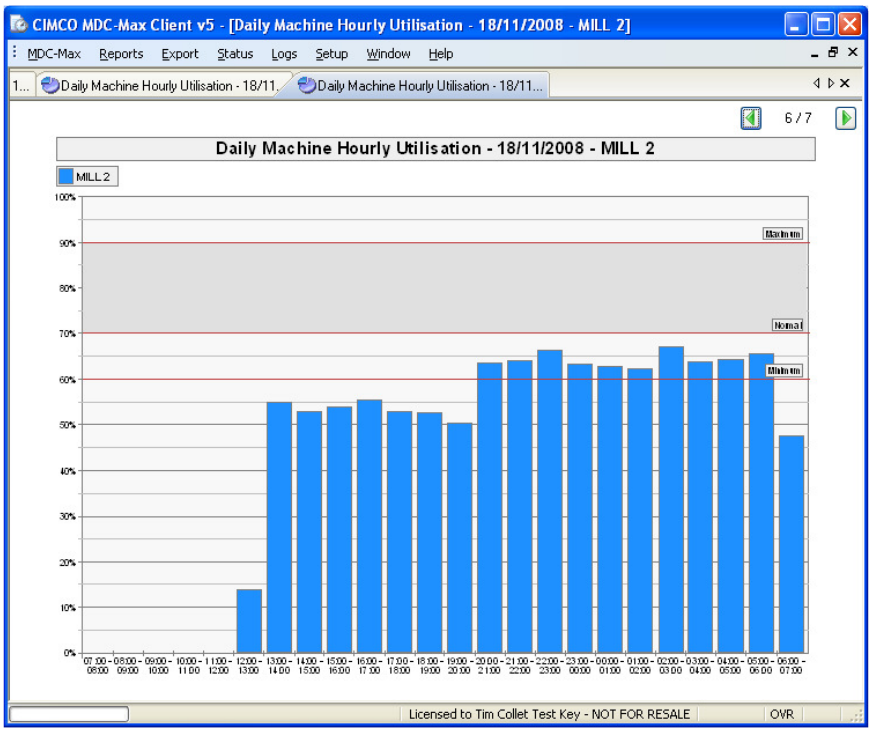
The system will then produce a single graph for each machine similar to the one below.



To make it more obvious which machine the graph is for, go to the General menu, and edit $REPORTMACHINE into the title.

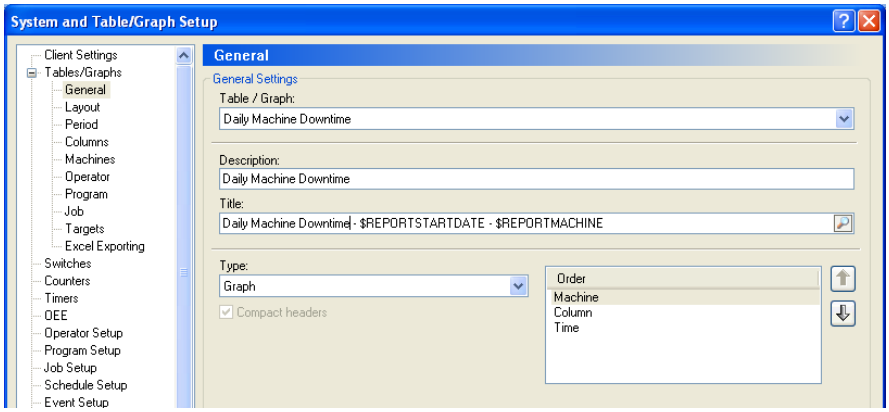


This will put the machine name onto the graph header for each machine as follows:-

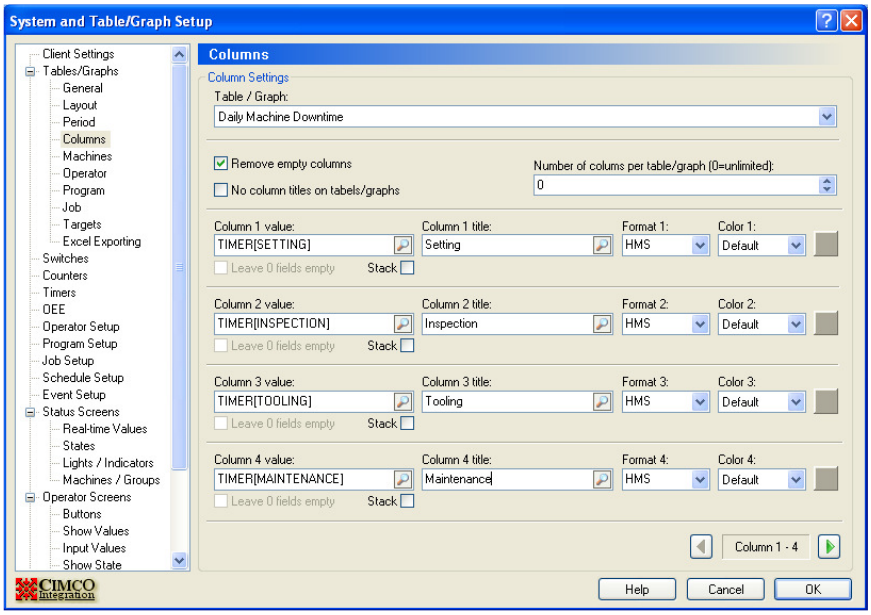


9.8 Adding downtime totals to machine graphs

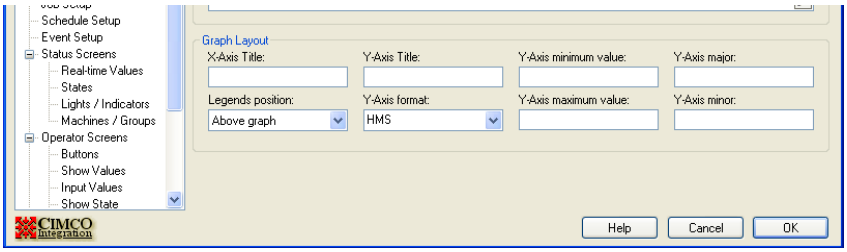
There is often a requirement to put more than one column of data on a graph, for example machine stoppage reason codes. To do this copy the Hourly utilisation graph we just created and edit the description and title to reflect that this is to be a downtime graph.



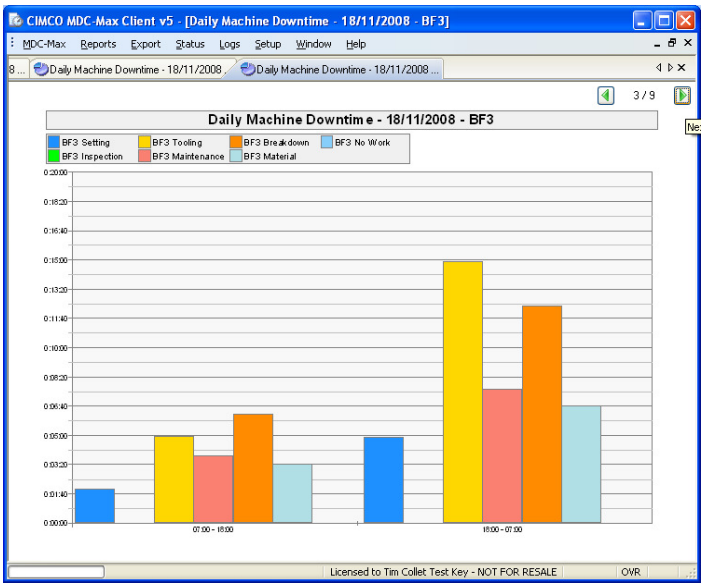
Go to the columns menu and for each machine downtime reason timer add a column, put in the relevant title and use the HMS format.



The arrow buttons by the Column 1-4 marker let you add more colums of data. On the layout menu change the Y-Axis format to HMS and delete the Y-Axis maximum value



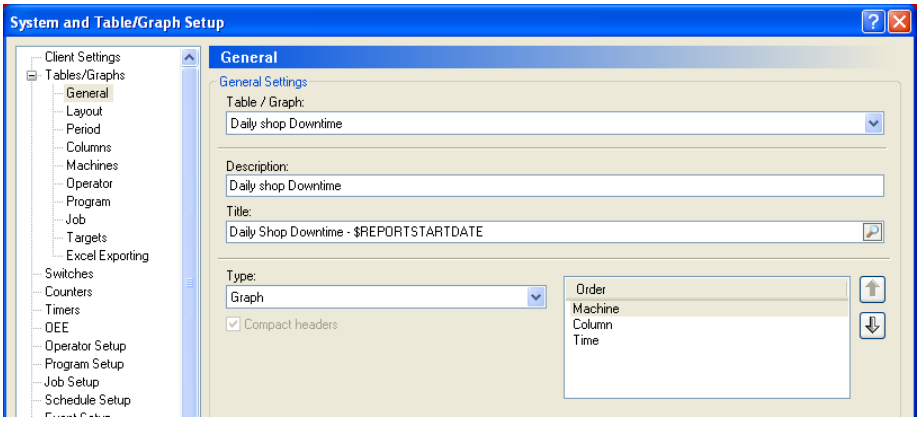
On the Targets menu disable the targets, and the result should resemble the following



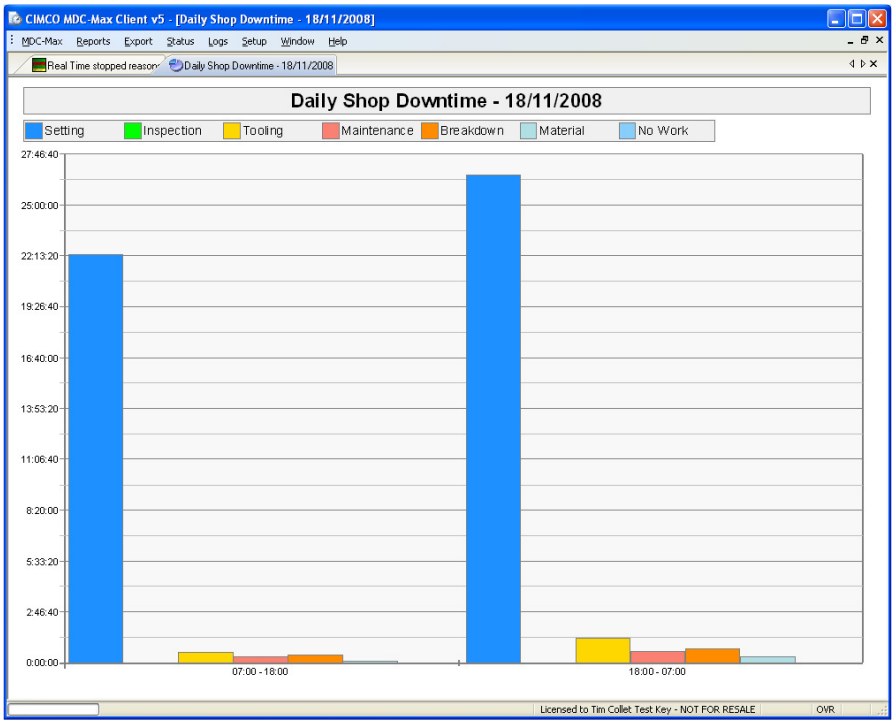
The Y axis is set automatically to the largest value on any of the graphs in the group.

9.9 Displaying total downtime by reason on a graph

It is often useful to display the total downtime for all the machines in the shop on a single graph. This would give a good indication of shop wide problems. To do this copy the last graph and name the copy as follows.



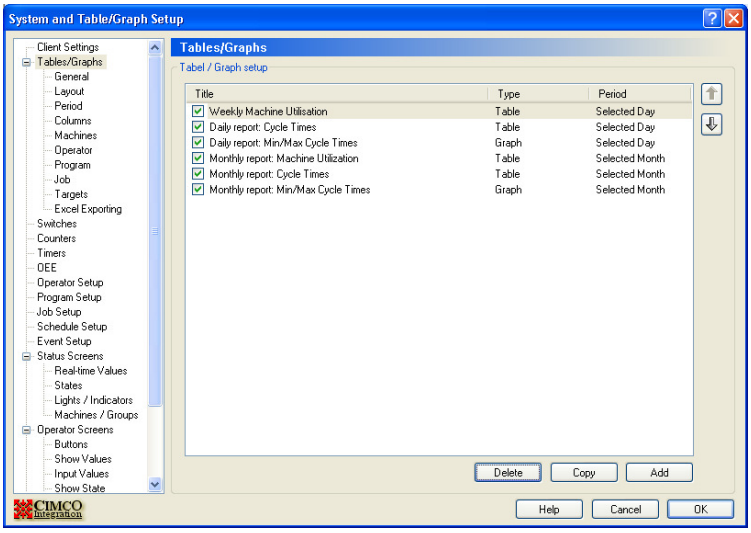
Go to the machines menu and uncheck the 'Include machine information' box, this will put all the downtime for all the machines on one graph. In the example below it is then very clear that the shop concerned needs more setters



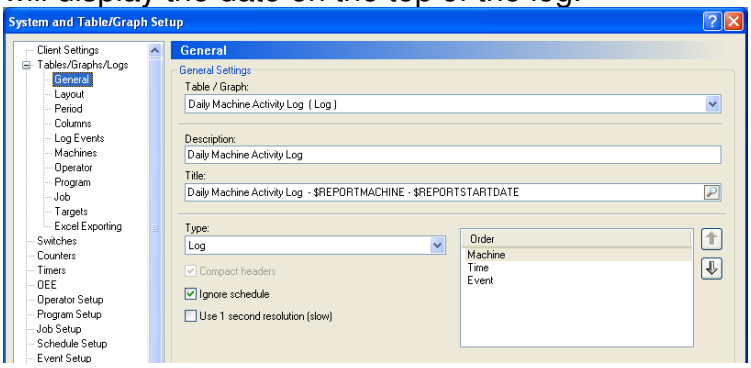
Chapter 10 Setting up an Event Log Report

A log Report displays an event or multiple events from the MDC-Max system in time order by Operator, Machine and Job.

For our first Log we will create a simple machine activity Log.
On the main MDC-Max screen click Setup, System Setup then click on the 'Tables/Graphs' link on the left.

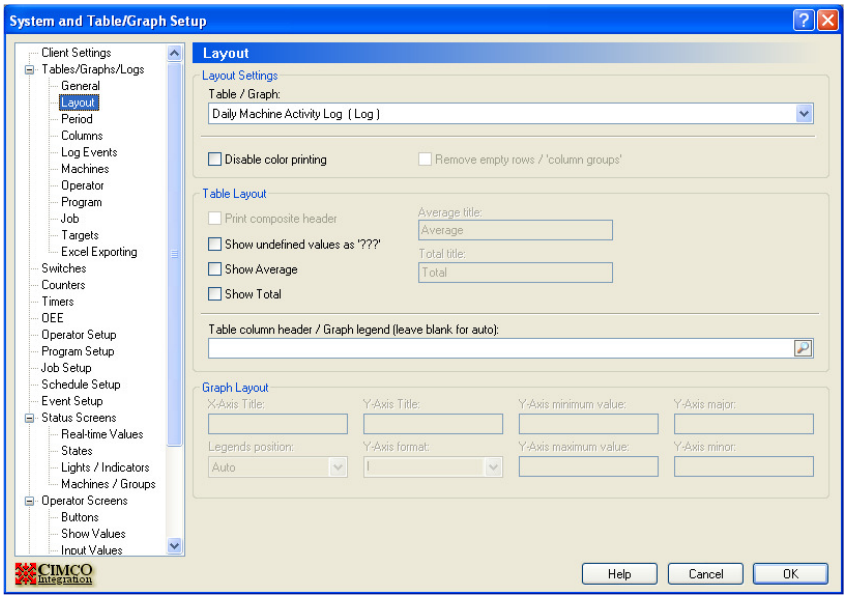


Click the Add button to see the screen below and type a description in the Description field – this is the name of the chart. Type a title in the Title field – this is what is displayed on the actual Log in this case the $REPORTMACHINE will put the machine name and $REPORTSTARTDATE will display the date on the top of the log.



The type must be set to Log – this produces a Log chart rather than a normal table or graph.
The tick box for 'Ignore Shedule' means that the shift pattern is ignored on the log chart. The 'Use 1 second resolution' box should normally be left un-ticked for most logs as it dramatically slows the generation of log charts. The 'Order' will determine how the data is displayed on the log. In this case we will be producing one page per machine so the Machine must be the first item in this list.

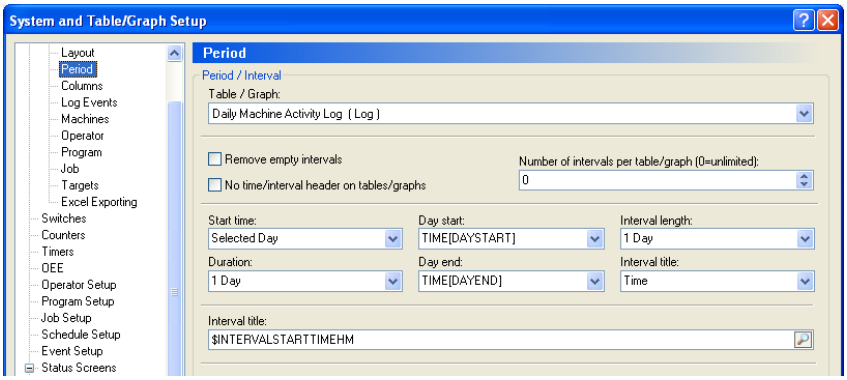
Click on the Layout menu on the left of the screen and the layout page will appear



The layout determines how the data will be laid out on log chart. For a Log chart this page does not normally need editing.

10.1 Setting the period of an event log

Click on the Period menu on the left to determine the timescale of the Log.



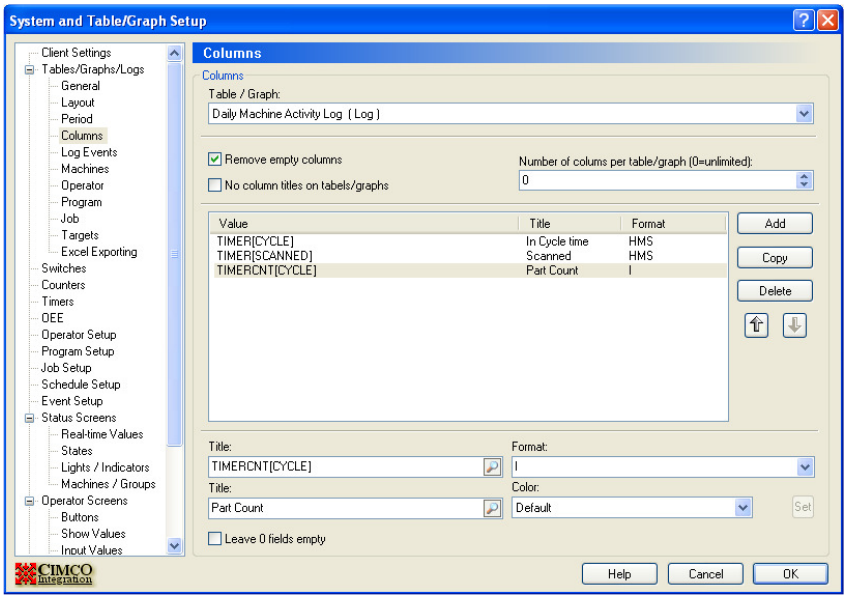
“Start Time” and “Duration” determine the total period of the Log. Selected Day means that when we run the Log the user will be able to select a day from a calendar. We want to report on a single day so the duration is 1 day.

The interval length for a log should normally always be set to the same value as the duration. The “Day Start” field is set to TIME[DAYSTART] – this means the Log will start at the beginning of the first shift.
The “Day End” is set to TIME[DAYEND] so the Log ends at the end of the final shift.

If your first shift starts at 6 am and you run three shifts ending at 6 the next morning, the graph above will run from 6 to 6, not from Midnight to Midnight.

10.2 Selecting which events to include in an event log

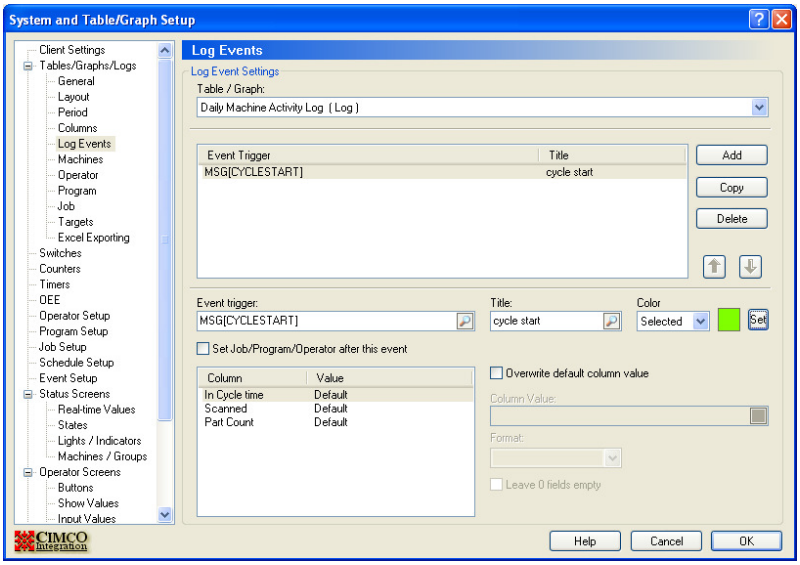
Click on the Columns menu on the left to determine what values are displayed

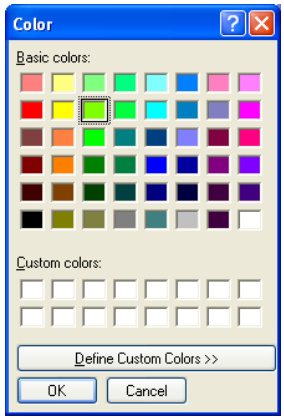


Each Log can display multiple columns of data per machine but in this example we initially only want to see how long the machine has been running, and how long it has been stopped for a scanned reason and how many parts it has produced

The Format determines how the data is to be displayed (the drop down menu icon gives a series of valid formats) in this case we use HMS to display the time as Hours, Minutes and seconds for the two timers. And the value TIMERCNT[CYCLE] to give a part count (format I for integer)

Click on the events menu to set up which events will be displayed on the Log chart

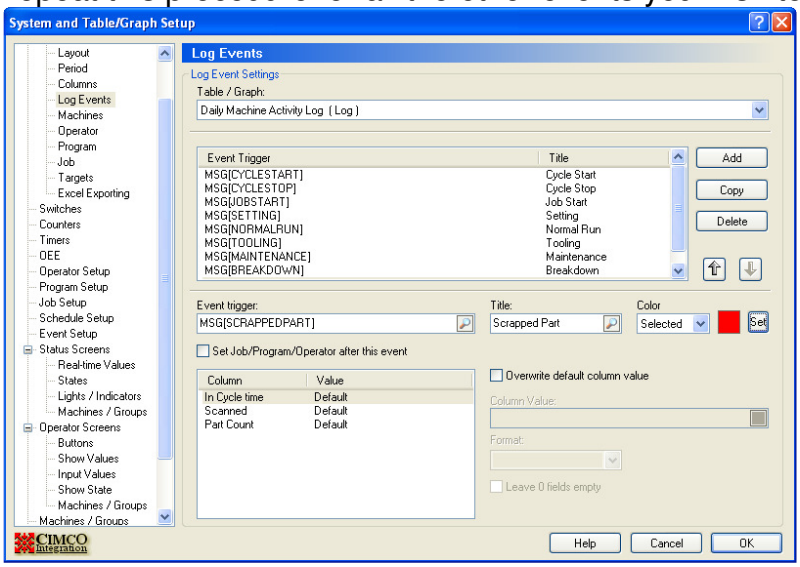




Click on Add and choose the first event you wish to log. In this example we wish to record the actual time that each Cycle start occurs. Use the search

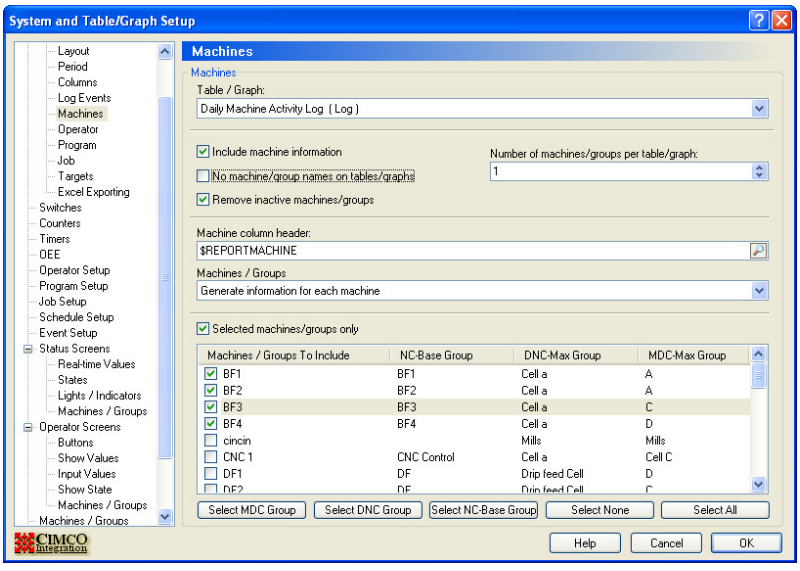
icon to edit the Event trigger value and then scroll to find the event (MSG[CYCLESTART] in this case). Type in the title you wish to occur on the log, then determine the colour you wish to use on the log for that event.

Repeat this procedure for all the other events you wish to appear on the log.



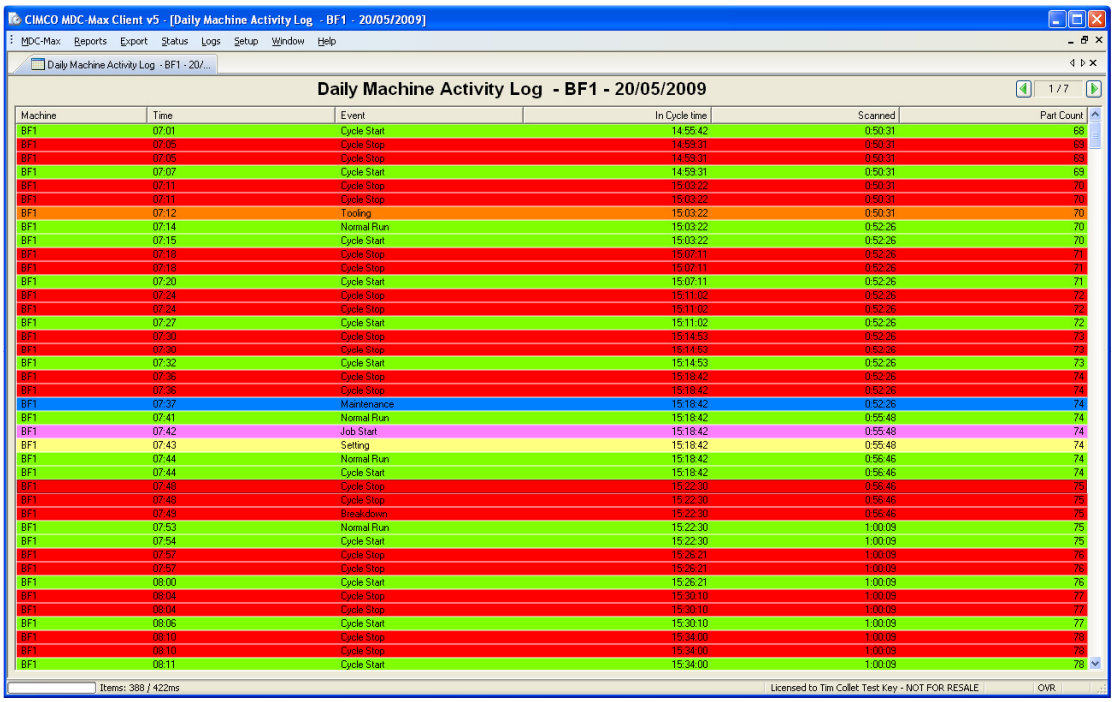
10.3 Adding Machine Information to the event log

Finally click the Machines menu on the left to edit machine info.
This page determines how the data is displayed by machine and what machines to include.



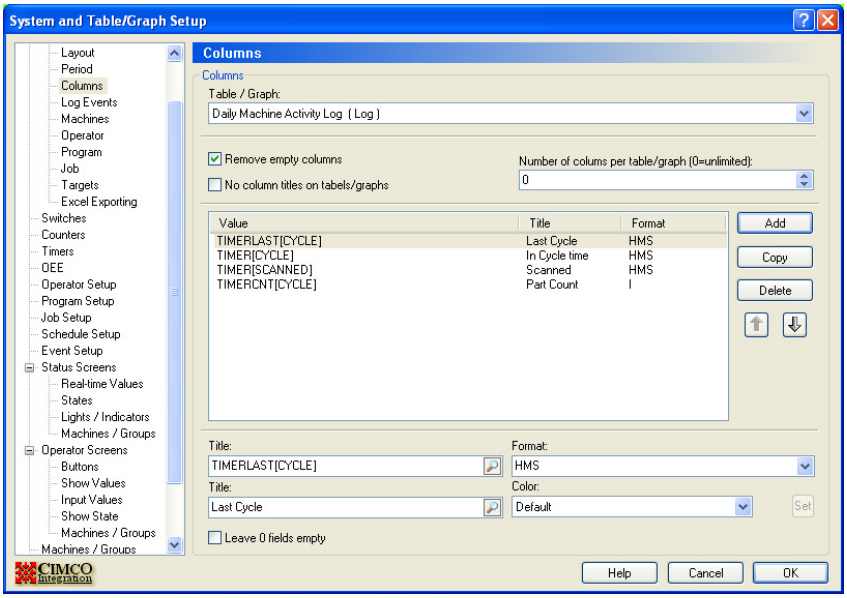
Ticking the “Include machine information” field and setting the “Number of machines/groups per graph/graph” to 1 will cause the log to display one page per machine.
Ticking “Remove inactive machines/groups” stops the log creating empty log pages for inactive machines.

Here is the Log generated by the settings in our screen shots:



This produces a great deal of information about the running of the machine, additional columns can be added, for example the time of the last cycle and the Job Name can be added.

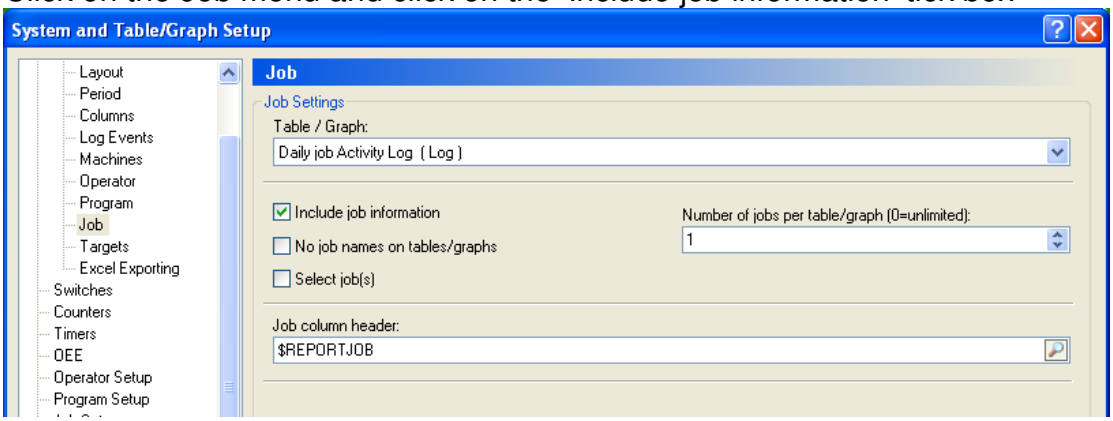
Click on the Columns menu and then add the variable ‘TIMERLAST[CYCLE]’. This will display the time of the last cycle, its format is HMS and the title is Last Cycle. Once added, use the arrows to set the order of the values on the log.



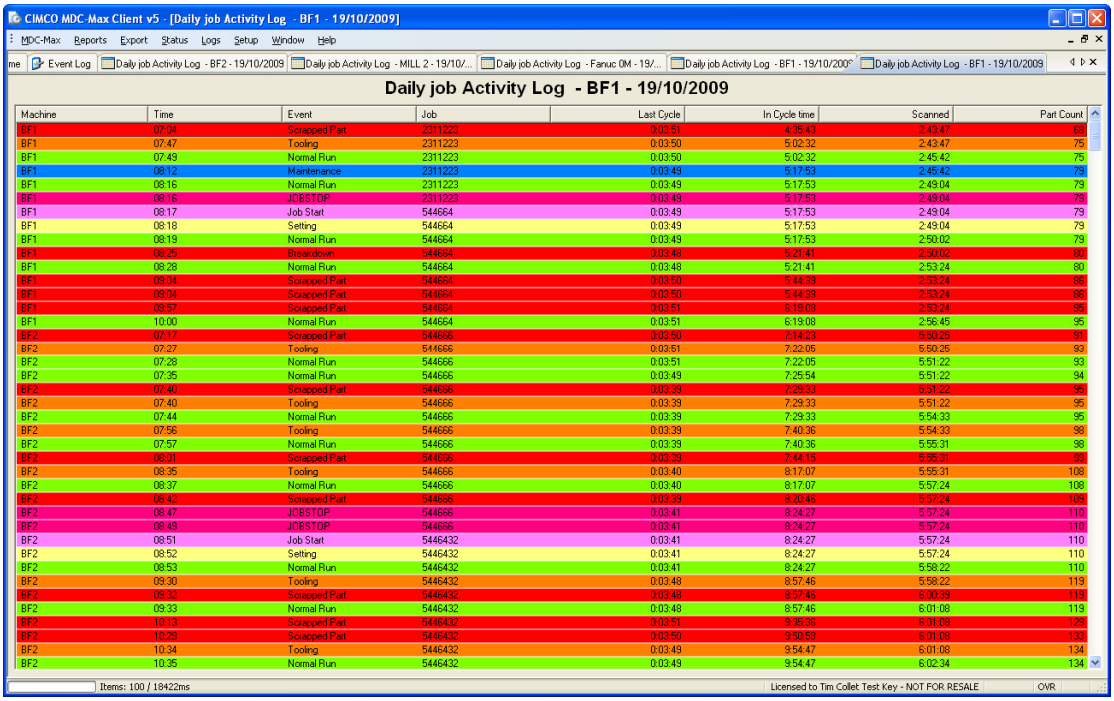
Various other events can be added to the system to log error codes etc to build a complete log of the machines activity.

10.4 Adding Job Information to an Event Log

Click on the Job menu and click on the 'Include job information' tick box

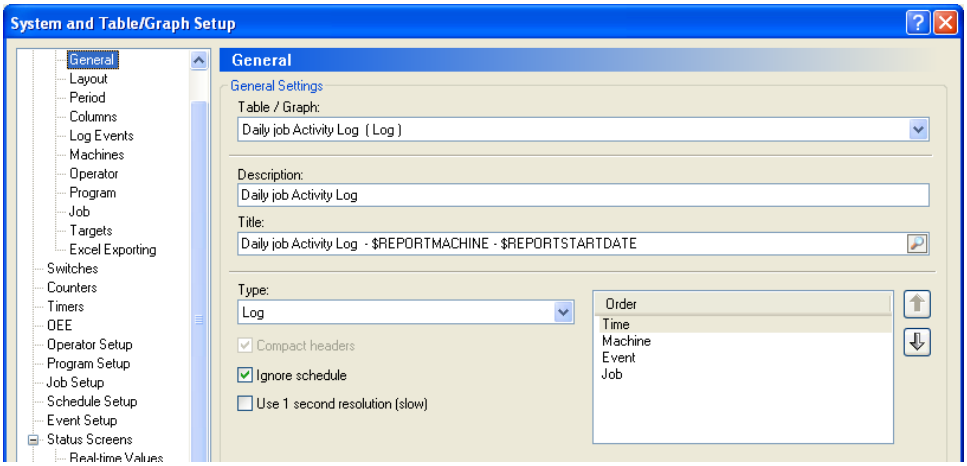


The resulting log will then have the job name and the last cycle time as below.

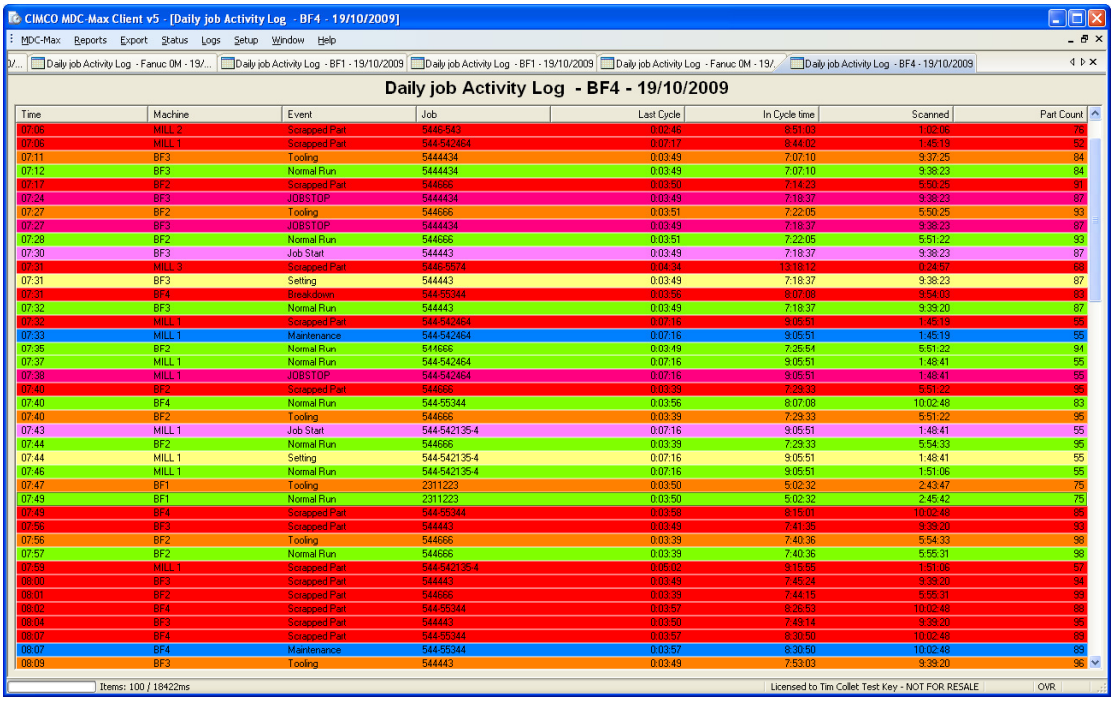


This will display all the jobs and machines on a single log on a machine by machine basis. These can be separated into separate logs depending on the settings in the system.

For example if a time line log is required for each machine this can be achieved by setting the time as the first item in the general settings page as below

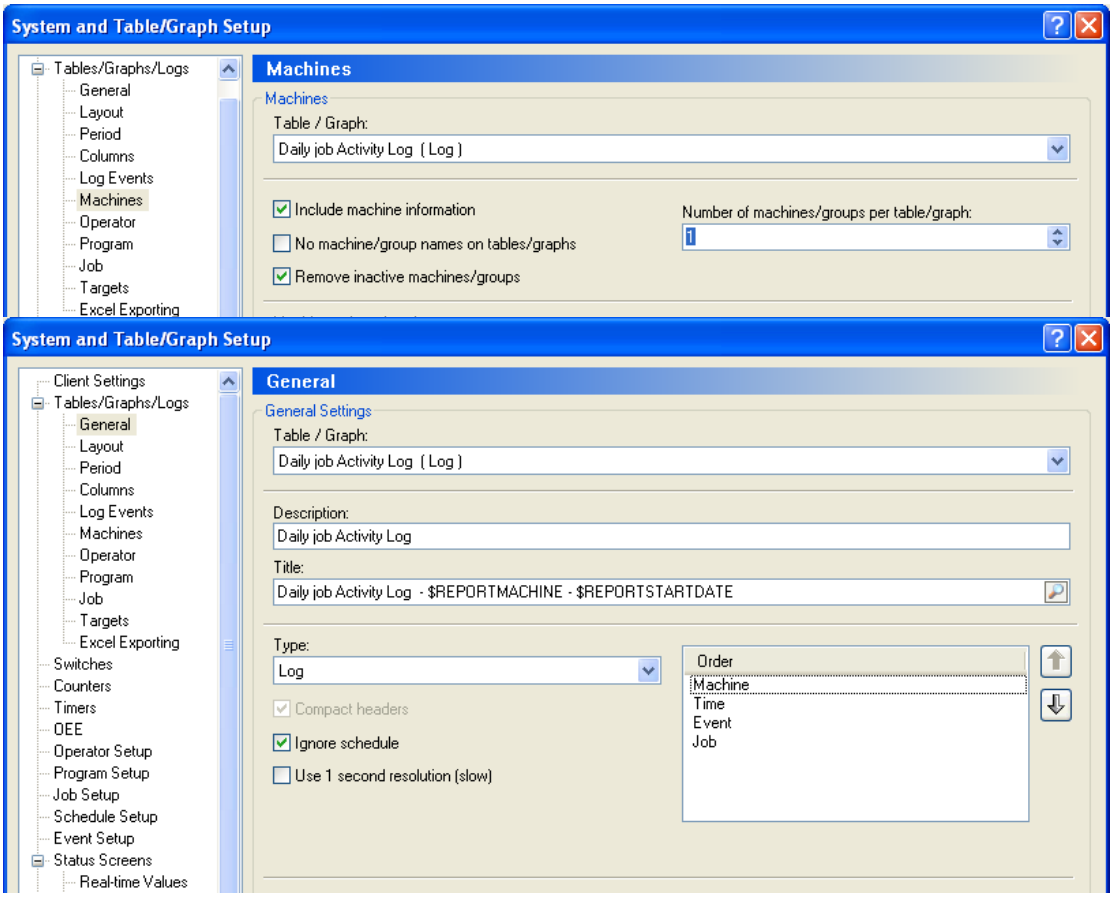


This makes the time the first column. So the timeline for all the machines will be displayed as follows.

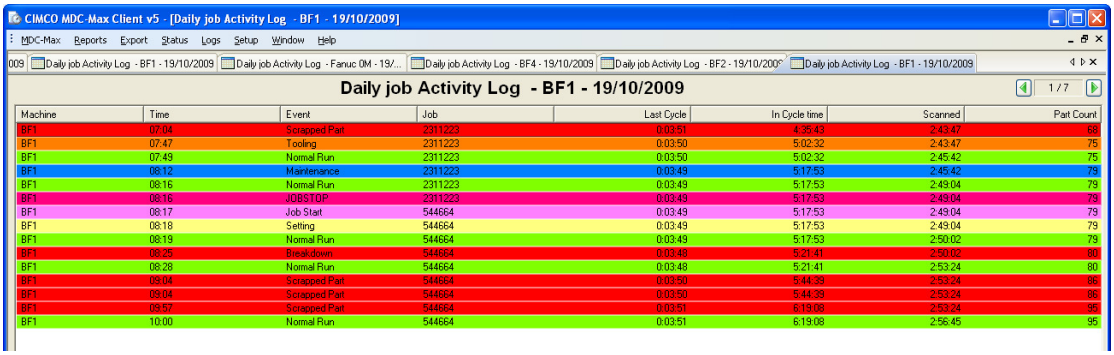


10.5 Creating one Log per Machine

The log can be modified to produce one log per machine by editing the machine options to display 1 machine per table as follows, and making the machine the first item on the general settings page.

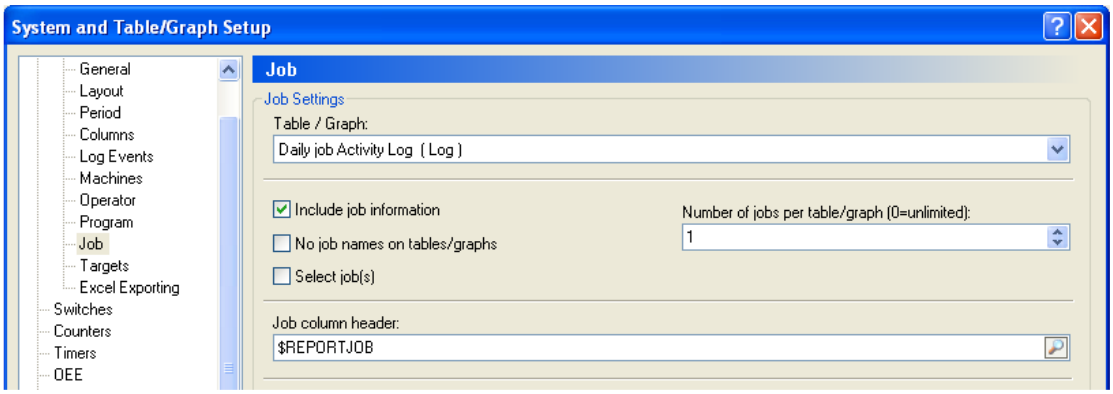


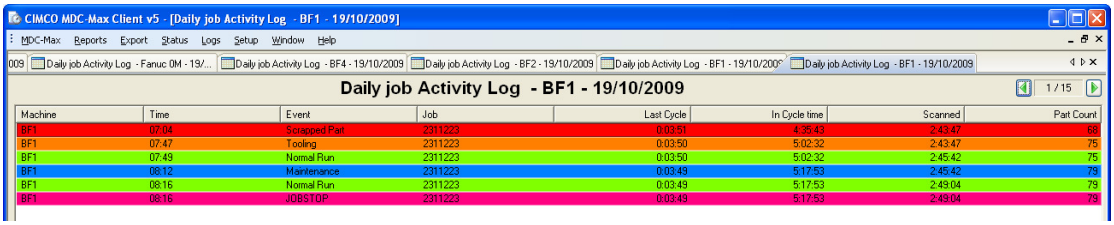
The resulting log will produce one page for each machine which will show the activity for whatever jobs are run on that machine.



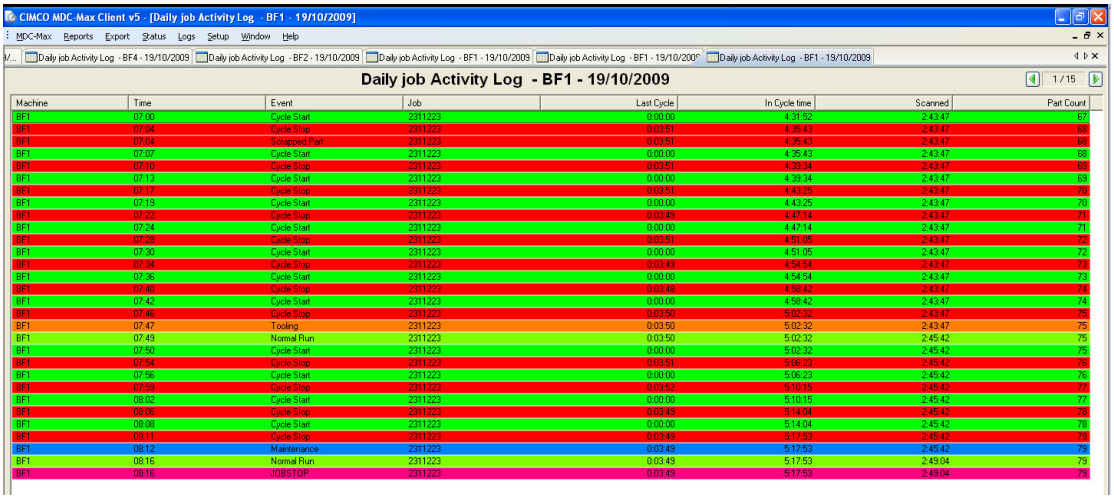
10.6 Creating one page per Job

In a similar way if the option to display 1 job per table in the job section of the setup is configured as below each job will be displayed on a separate page.

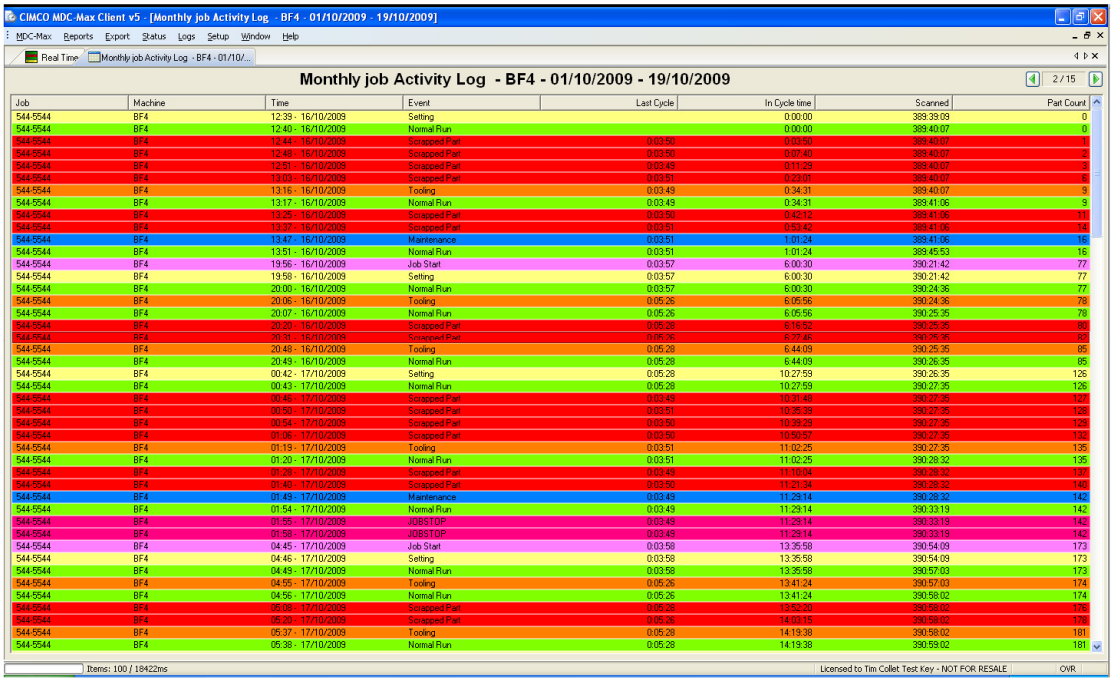




If the cyclestart and cyclestop events are added to the 'Log Events' settings at this stage a verbose log of each cycle of the machine for each job will be produced.

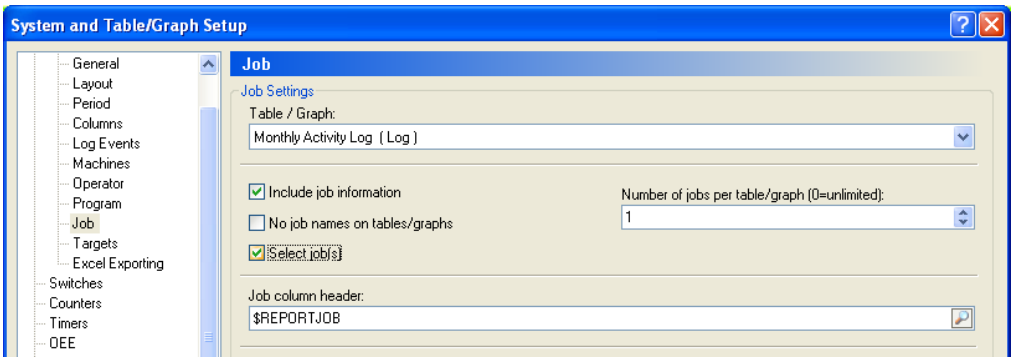


This can be further configured by adding or removing log events and changing the period of the log to suit customer requirements, as per the screen below, which shows the activity on a particular job over a period of two days.

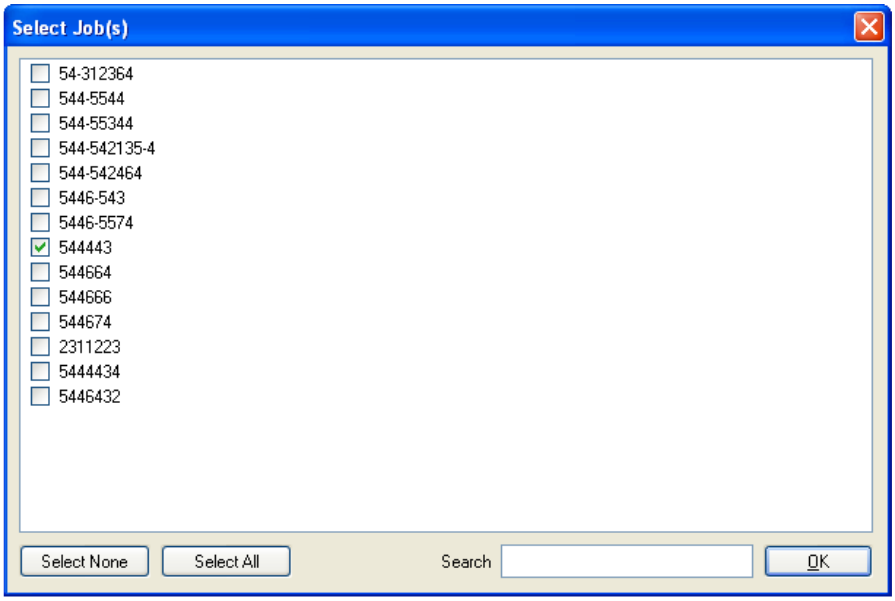


10.7 Selecting an individual Job Log

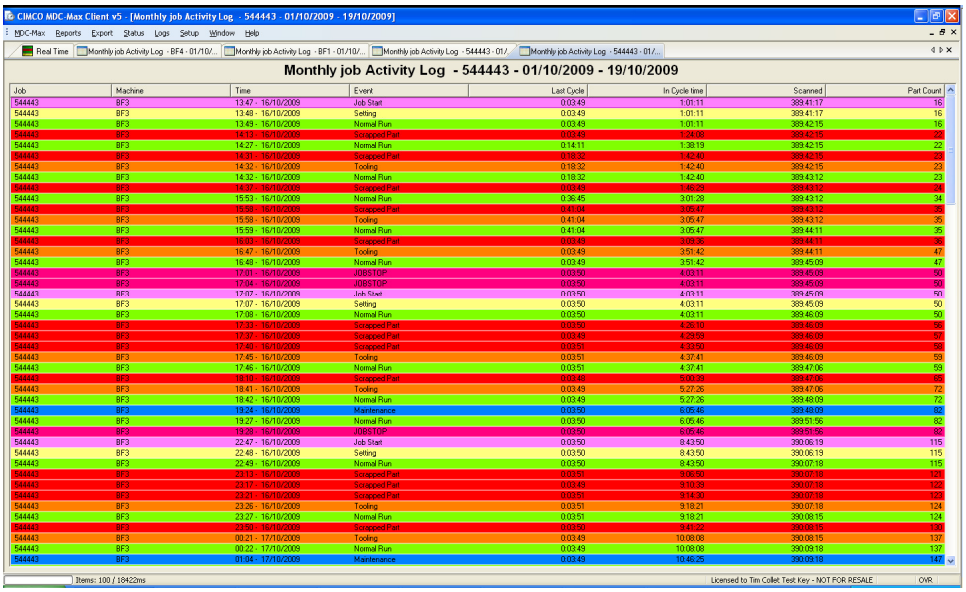
To save having to look through lots of pages of log files for a single job, it is possible to configure the system to select which jobs are to be displayed. The 'Select Jobs' option on the 'Job' setting page lets the operator decide which jobs to produce a log table for.



If this option is ticked MDC max will display a 'Select Job(s)' screen to allow the operator to decide which job to produce a log for.

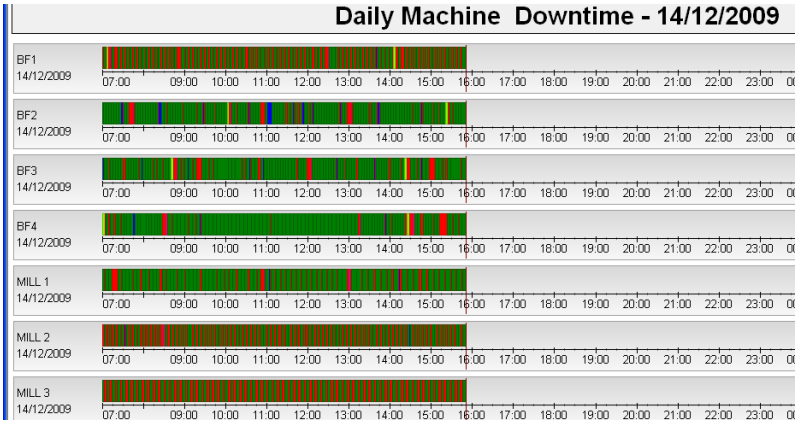


The system will then just produce a log for the selected job.



Chapter 11 – Creating a Realtime Timeline or Gant Graph

MDC-Max can create a bar graph for each machine where the bar section colour changes according to the machine state as below:-

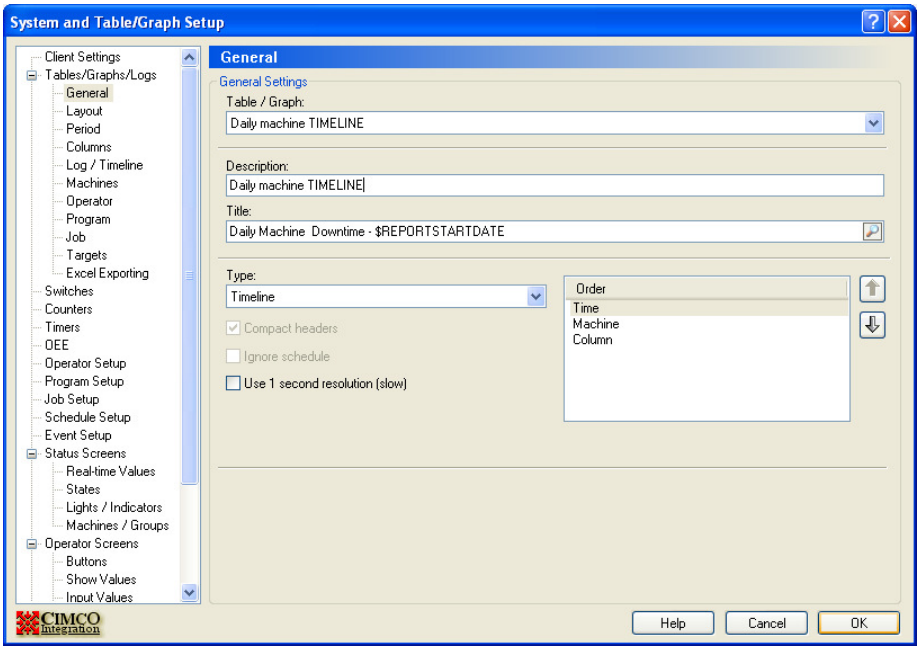


The user can then zoom in on a section of the chart and hover the mouse over a section to get popup statistics such as part count. This is much faster than generating a report and scrolling through it to find the right section.

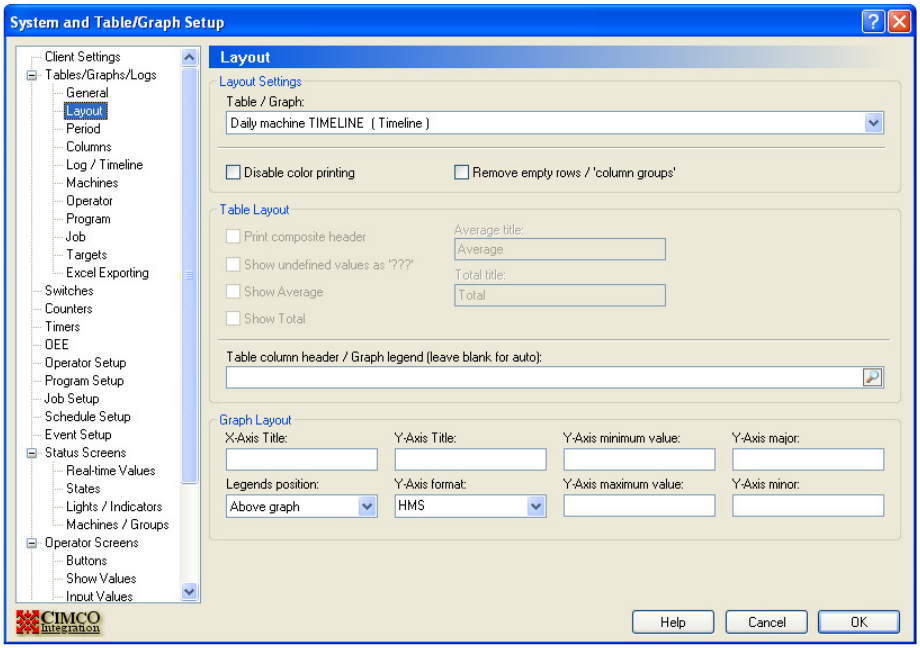
These timeline graphs can be generated for any date and if you create one for today and leave it on the screen it will be updated automatically with the current machine status. This realtime timeline is the preferred method of finding cycle times for many customers.

11.1 – Setting up a Timeline or Gant Graph

To produce a time-line for a single day we need to create a new graph as follows



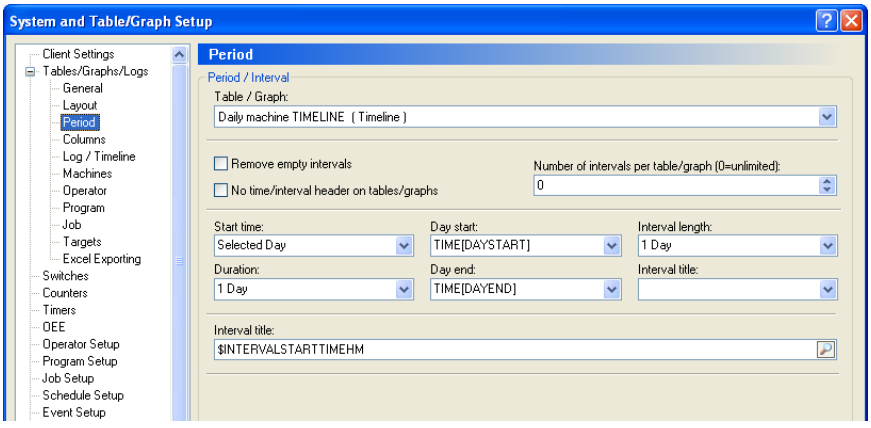
The type must be set to Timeline and the order set to ‘Time’ ‘Machine’ then ‘Column’. Once you have created the graph click on the Layout menu on the left of the screen and the layout page will appear



Set the y axis format to HMS (Hours Minutes Seconds) – this will display the time across the page.

11.2 Choosing the period for the Timeline

Click on the Period menu on the left to determine the timescale of the Timeline.



“Start Time” and “Duration” determine the total period of the timeline. Selected Day means that when we run the graph the user will be able to select a day from a calendar. We want to report on a single day so the duration is 1 day.

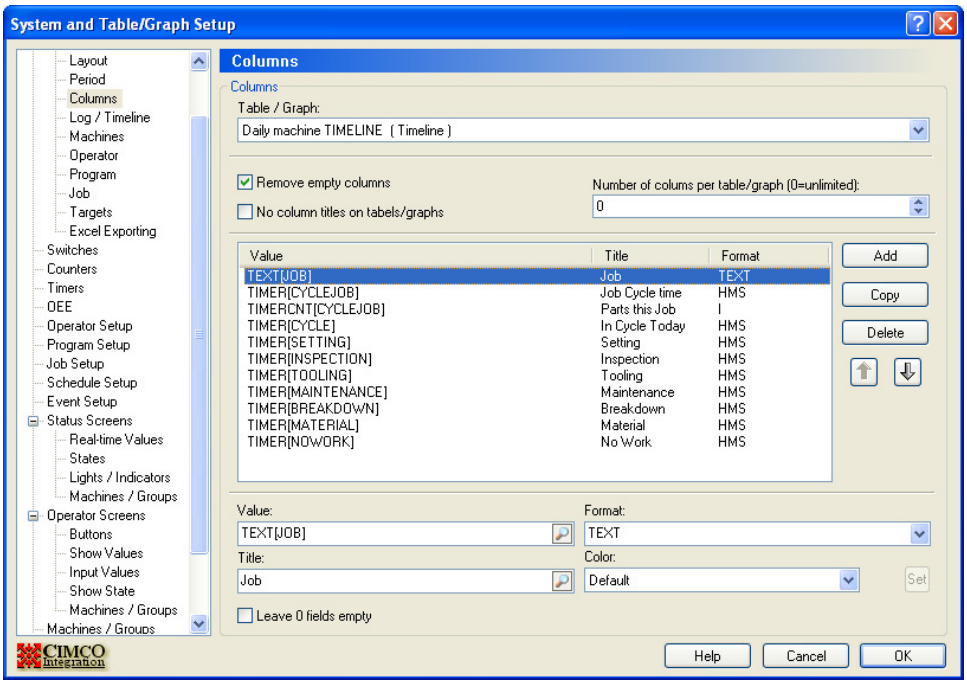
A timeline would usually be set up for a whole day so the interval length should be set to 1 day, this will display a whole day on one page. The “Day Start” field is set to TIME[DAYSTART] – this means the graph will start at the beginning of the first shift.

The “Day End” is set to TIME[DAYEND] so the graph ends at the end of the final shift.

If your first shift starts at 6 am and you run three shifts ending at 6 the next morning, the graph above will run from 6 to 6, not from Midnight to Midnight.

11.3 Choosing the Popup Information for the Timeline

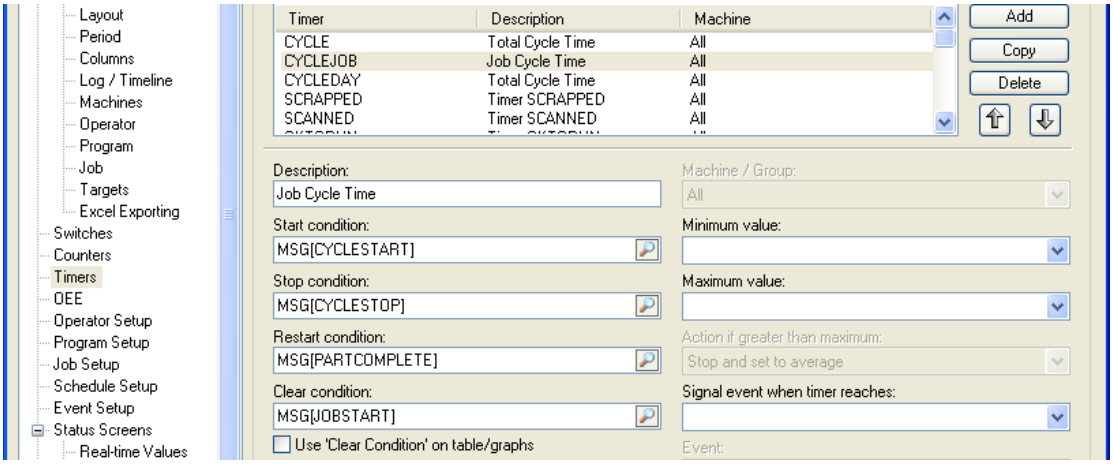
Click on the Columns menu on the left to determine what is displayed in the Popup window for each period of the timeline.



We are going to display the job the machine is working on, how long the machine has been in cycle on that job and how many parts have been produced for that job so far (see below for new timer required). We will also display the total cycle today and the amount of time the machine has been stopped for setting, inspection etc.

Add each item in turn using the Add button and the drop down menu as with a normal graph. The format must always be correct for the value you are adding. For example the job name will be TEXT, the parts count will be an integer (a real number) and any times will be HMS.

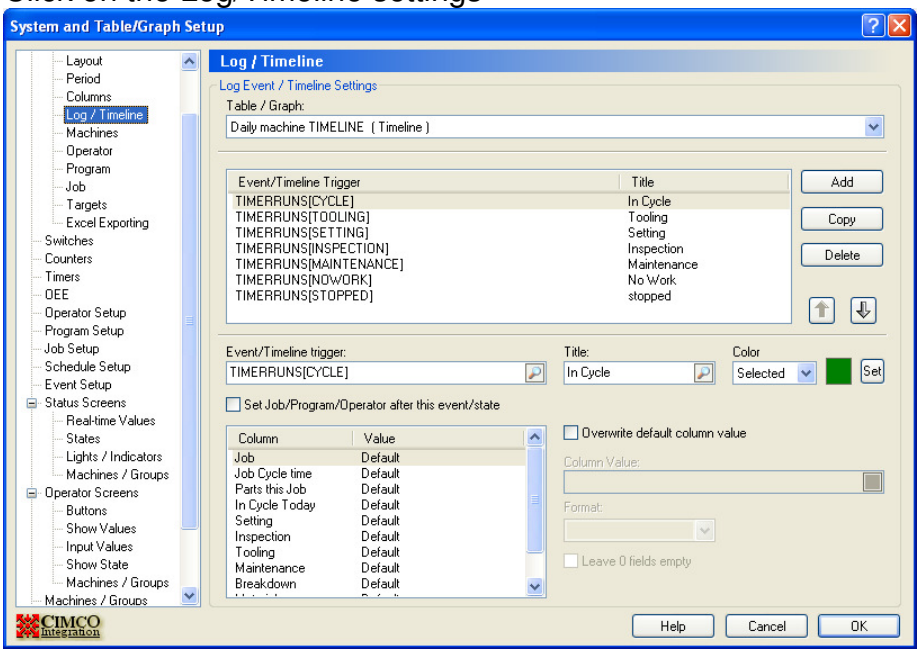
In order to display the amount of time spent on a particular job (provided we have a means of logging the start of each job), we will need to create a new timer called TIMERJOB which clears itself at the start of each new job. Here is setup for the timer (refer to section 5.1 on how to setup a new timer) :-



Notice the only difference to the Cycle timer we setup in the earlier sections of the manual is the Clear Condition – MSG[JOBSTART]

11.4 Choosing the timeline state and colour

Click on the Log/Timeline settings



The machine can only be in one state at a time (ie it is running, stopped for inspection, stopped for maintenance or just stopped for no reason). It is these states that will be displayed as colours on the timeline in exactly the same way as we displayed them on the live screen in section 6.3. Use the same colour for each state on the timeline as you used on the livescreen for consistency.

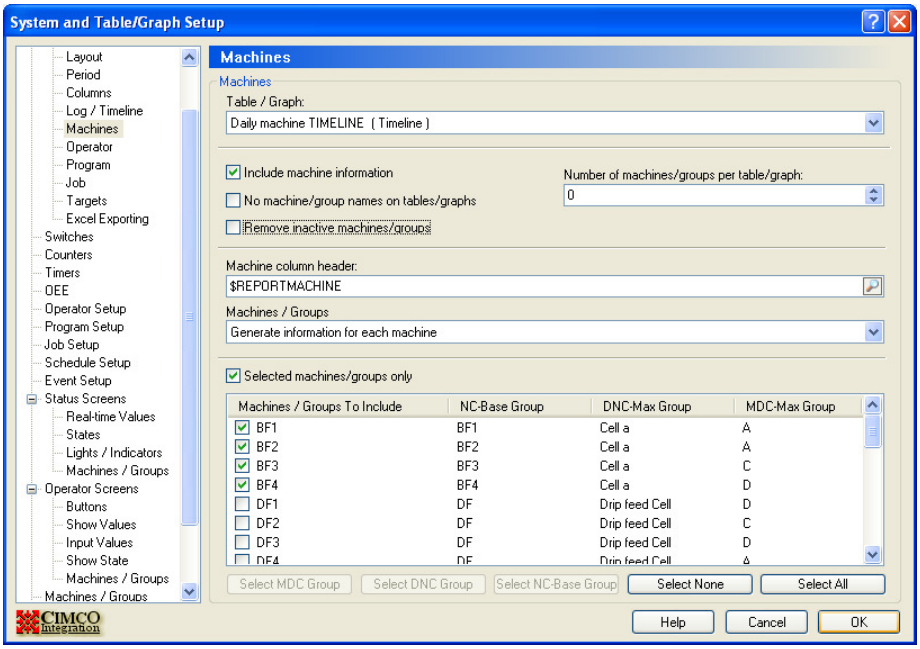
Each machine state will be indicated by a TIMERRUNS(timername) variable. For example TIMERRUNS[CYCLE] is always turned on whenever the timer CYCLE is running and this will be our first state.

Add each of the states you want to display on the timeline by clicking the add button near the Event/Timeline trigger. Use the search icon to select

TIMERRUNS[CYCLE]. This would give us the actual run time in hours minutes and seconds since the timer was reset. Then type in a title for the trigger and select a colour for that state. Repeat for each machine state as above.

11.5 Choosing the machines for the timeline

Finally click the Machines menu on the left to edit machine info.
This page determines how the data is displayed by machine and what machines to include.

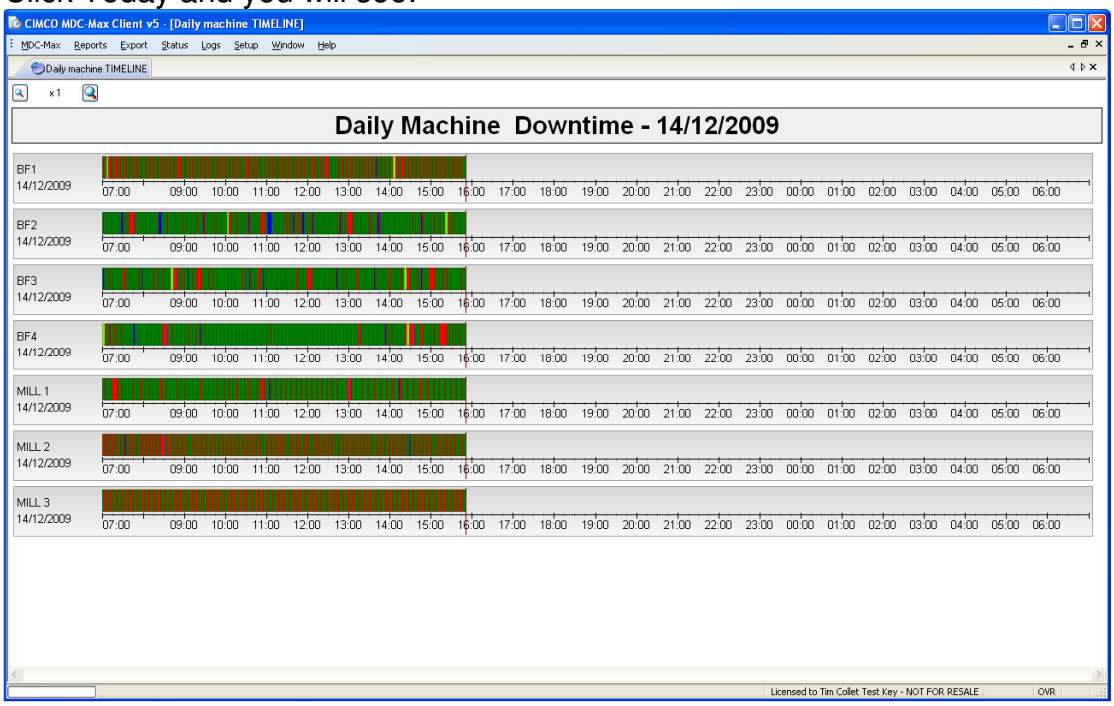


Make sure the “Include machine information” field is ticked (so a timeline is produced for each machine)
The “Number of machines/groups per table/graph” field determines how many machines will be displayed on each page. If you have a large number of machines, set this to 8 and you will only get 8 machines per page.
The ‘Machine column header’ determines the name of each machine on each timeline.
Finally it is possible to select which machines you wish to display by ticking the ‘Selected machines/groups only’ field and selecting the machines in the list below it. Click OK to save you changes.

11.6 Viewing the timeline for any day.

Click Report, Generate Graph and choose the Daily Machine Timeline report. You are then prompted for a date. If you choose a date before today you will get a complete timeline for the whole day. If you choose today you will get a partial timeline upto the current time which will then update in realtime as the machine states change.

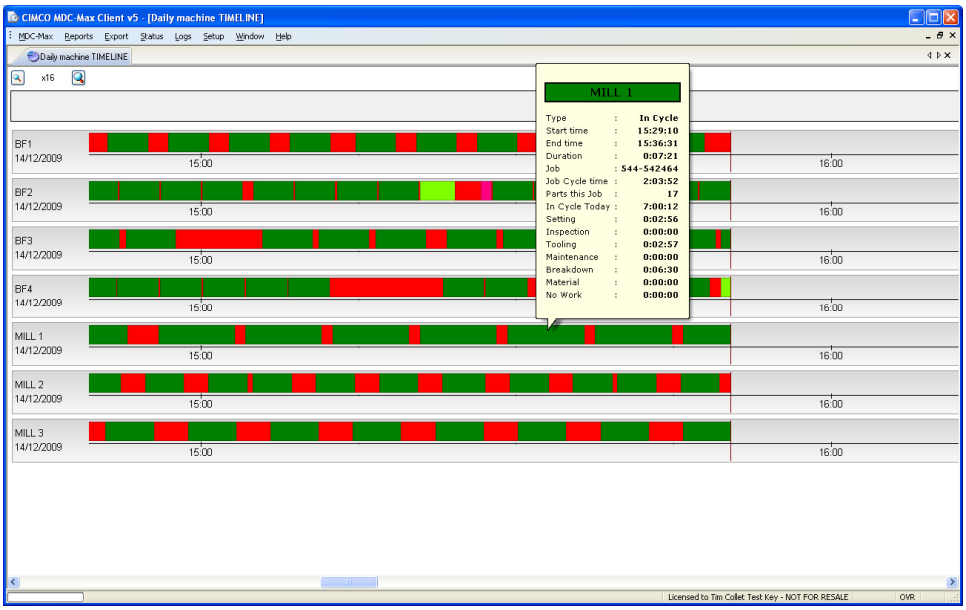
Click Today and you will see:-



This shows activity from the start of the current day until the current time. You can zoom in on any event on the graph by pointing the mouse at a particular event and using the mouse scroll button to zoom in and out.

11.7 Viewing Popup information on a timeline.

By letting the mouse hover over an event block the popup window for that event will be displayed as per below.

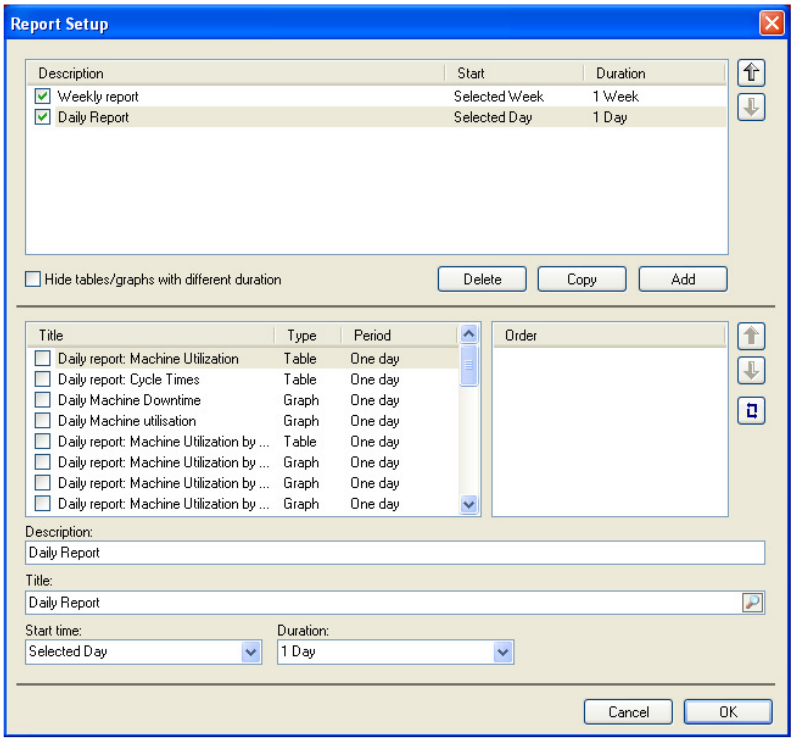


Here we can easily see the machine name, the type of event (i.e. in cycle) the start and end time of the event and its duration, along with the Job name, the time in cycle on that job, the number of parts produced, the time the machine has been in cycle during the current day and the timings for all the other stoppage reasons.

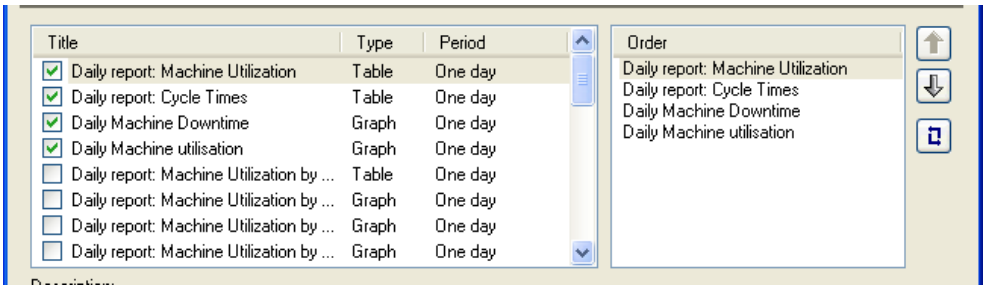
Chapter 12 – Grouping tables and graphs into a single report

A Report is simply a collection of graphs and tables collected together into a report. This can then be printed or exported to a PDF file.

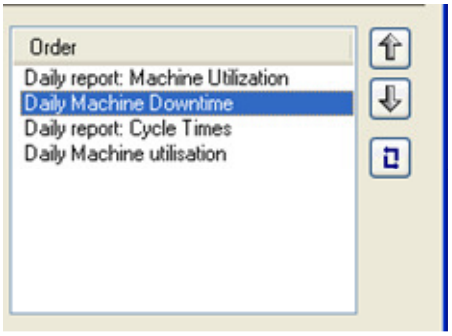
From the MDC-Max client click Setup then Report Setup then click on the Add button.



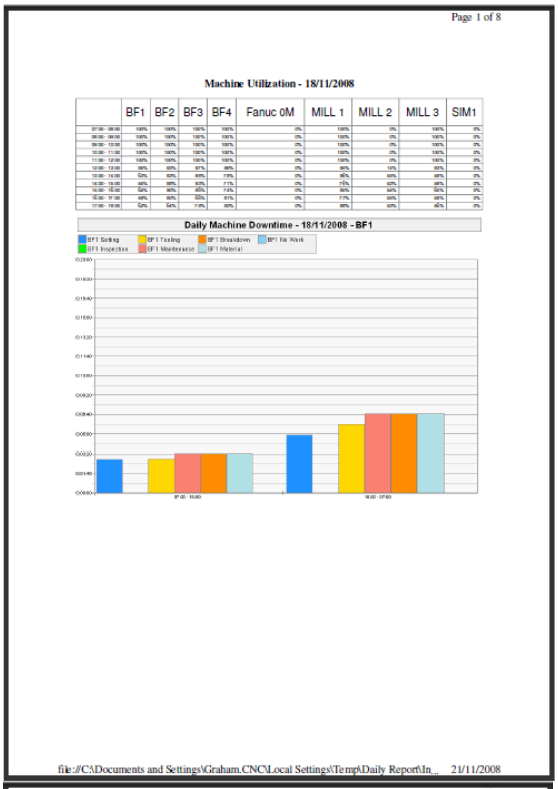
Type in a description and title for the report then select the start time and period. For a daily report this is normally set to 'Selected Day' and Duration 1 Day.
Next select the tables and graphs you require in the report, as they are selected they will appear in the Order window to the right of the screen. Always make sure that the period of the tables and graphs you are selecting for a report matches the duration of the report you are building.



Next set the order you with the tables and graphs to appear in on the report. To do this highlight the table or graph in the 'Order' box and use the Up and Down arrows to change its position in the list.



The result here is that the Daily Machine Downtime will now appear below the machine utilization table and above the Daily Report Cycle Times. Click the OK button to confirm the report is finished. By going to the Reports drop down menu on the MDC page and selecting Generate reports it should now be possible to select the new daily report, it should create the series of graphs and tables selected, where the graphs or tables had multiple sheets these will all be displayed, they can be printed by clicking the right mouse button and selecting print. The example shown would produce a series of pages similar to the screen shots below.



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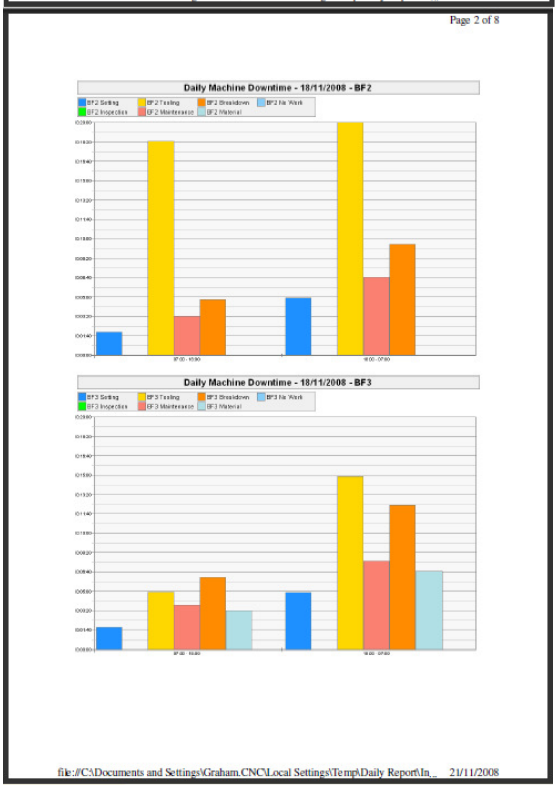
Machine Utilization - 18/11/2008

	BF1	BF2	BF3	BF4	Fanuc 0M	MILL 1	MILL 2	MILL 3	SIM1
07:30 - 08:30	100%	100%	100%	100%	0%	100%	0%	100%	0%
08:30 - 09:30	100%	100%	100%	100%	0%	100%	0%	100%	0%
09:30 - 10:30	100%	100%	100%	100%	0%	100%	0%	100%	0%
10:30 - 11:30	100%	100%	100%	100%	0%	100%	0%	100%	0%
11:30 - 12:30	100%	100%	100%	100%	0%	100%	0%	100%	0%
12:30 - 13:30	99%	93%	91%	99%	0%	98%	10%	93%	0%
13:30 - 14:30	52%	83%	89%	71%	0%	45%	66%	68%	0%
14:30 - 15:30	64%	89%	83%	71%	0%	73%	62%	68%	0%
15:30 - 16:30	64%	90%	85%	74%	0%	89%	64%	59%	0%
16:30 - 17:30	64%	90%	85%	81%	0%	71%	66%	68%	0%
17:30 - 18:30	52%	64%	71%	60%	0%	99%	60%	46%	0%

Daily Machine Downtime - 18/11/2008 - BF1



Daily Machine Downtime - 18/11/2008 - BF2

Daily Machine Downtime - 18/11/2008 - BF3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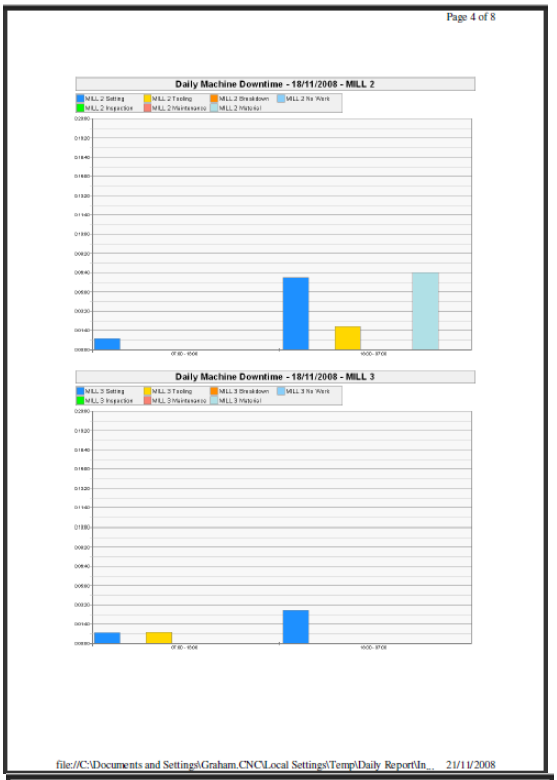
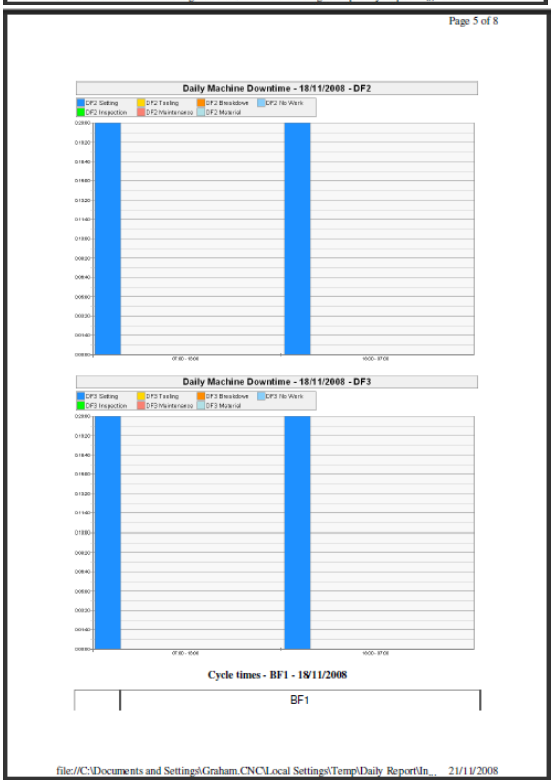
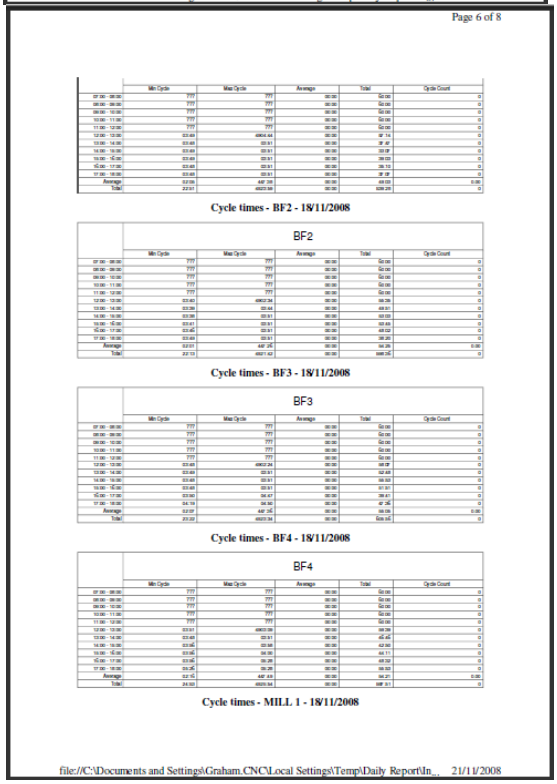
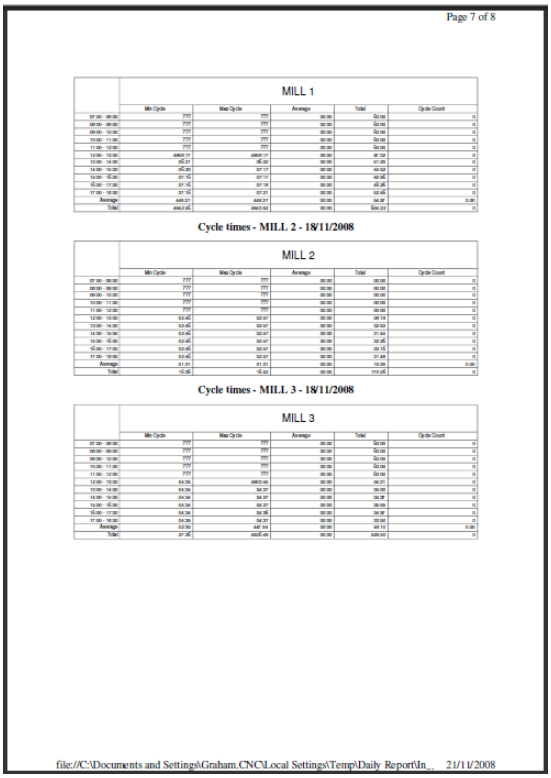
Daily Machine Downtime - 18/11/2008 - BF4
Daily Machine Downtime - 18/11/2008 - MILL 1
file://C:\Documents and Settings\Graham.CNC\Local Settings\Temp\Daily Report\In... 21/11/2008


Page 4 of 8
Daily Machine Downtime - 18/11/2008 - MILL 2
Daily Machine Downtime - 18/11/2008 - MILL 3
file://C:\Documents and Settings\Graham.CNC\Local Settings\Temp\Daily Report\In... 21/11/2008


Page 5 of 8
Daily Machine Downtime - 18/11/2008 - DF2
Daily Machine Downtime - 18/11/2008 - DF3
Cycle times - BF1 - 18/11/2008
BF1
file://C:\Documents and Settings\Graham.CNC\Local Settings\Temp\Daily Report\In... 21/11/2008


Page 6 of 8
Cycle times - BF2 - 18/11/2008
BF2
Cycle times - BF3 - 18/11/2008
BF3
Cycle times - BF4 - 18/11/2008
BF4
Cycle times - MILL 1 - 18/11/2008
file://C:\Documents and Settings\Graham.CNC\Local Settings\Temp\Daily Report\In... 21/11/2008



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MILL 1

	Min Cycle	Max Cycle	Average	Total	Cycle Count
07:00 - 08:00	???	???	00:00	00:00	0
08:00 - 09:00	???	???	00:00	00:00	0
09:00 - 10:00	???	???	00:00	00:00	0
10:00 - 11:00	???	???	00:00	00:00	0
11:00 - 12:00	???	???	00:00	00:00	0
12:00 - 13:00	49835.17	49835.17	00:00	97:02	0
13:00 - 14:00	06:20	06:20	00:00	01:20	0
14:00 - 15:00	05:26	07:17	00:00	03:52	0
15:00 - 16:00	07:15	07:17	00:00	00:00	0
16:00 - 17:00	07:15	07:18	00:00	00:00	0
17:00 - 18:00	07:15	07:21	00:00	02:45	0
Average	449.27	449.27	00:00	04:37	0.00
Total	4942.45	4943.02	00:00	104.21	0

Cycle times - MILL 2 - 18/11/2008

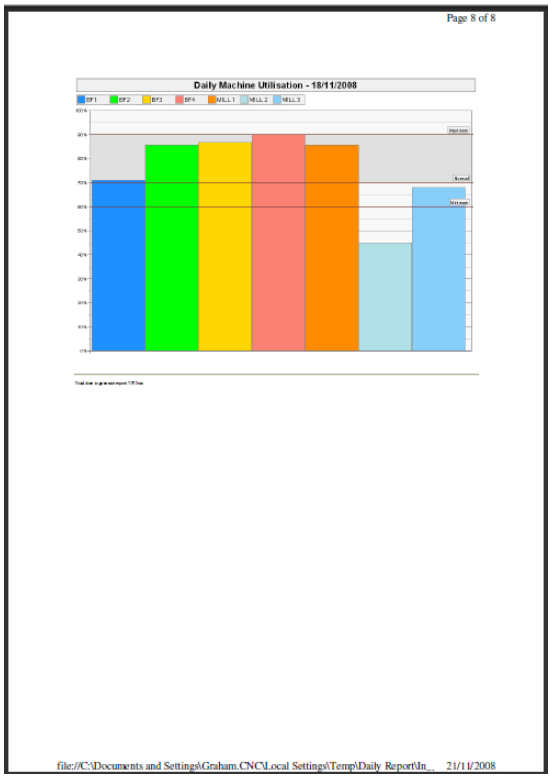
MILL 2

	Min Cycle	Max Cycle	Average	Total	Cycle Count
07:00 - 08:00	???	???	00:00	00:00	0
08:00 - 09:00	???	???	00:00	00:00	0
09:00 - 10:00	???	???	00:00	00:00	0
10:00 - 11:00	???	???	00:00	00:00	0
11:00 - 12:00	???	???	00:00	00:00	0
12:00 - 13:00	02:45	02:47	00:00	08:19	0
13:00 - 14:00	02:45	02:47	00:00	02:03	0
14:00 - 15:00	02:45	02:47	00:00	01:44	0
15:00 - 16:00	02:45	02:47	00:00	02:45	0
16:00 - 17:00	02:45	02:47	00:00	00:15	0
17:00 - 18:00	02:45	02:47	00:00	01:48	0
Average	01:31	01:31	00:00	15:00	0.00
Total	15:45	15:47	00:00	119:45	0

Cycle times - MILL 3 - 18/11/2008

MILL 3

	Min Cycle	Max Cycle	Average	Total	Cycle Count
07:00 - 08:00	???	???	00:00	00:00	0
08:00 - 09:00	???	???	00:00	00:00	0
09:00 - 10:00	???	???	00:00	00:00	0
10:00 - 11:00	???	???	00:00	00:00	0
11:00 - 12:00	???	???	00:00	00:00	0
12:00 - 13:00	04:39	49835.69	00:00	08:31	0
13:00 - 14:00	04:36	04:37	00:00	09:00	0
14:00 - 15:00	04:36	04:37	00:00	04:37	0
15:00 - 16:00	04:36	04:37	00:00	09:09	0
16:00 - 17:00	04:36	04:36	00:00	04:37	0
17:00 - 18:00	04:36	04:37	00:00	00:00	0
Average	02:30	4987.04	00:00	49.10	0.00
Total	37:45	49835.69	00:00	525.00	0



Chapter 13 Creating OEE Reports

The OEE figure for a machine can be calculated as the Availability multiplied by Productivity multiplied by Quality X 100%

The Availability is the total production time divided by the Planned production time.
The Productivity is the Planned cycle time divided by the actual cycle time
The Quality is the quantity of good parts produced divided by the total quantity of parts produced this takes into account all scrapped parts).

The Actual production time is the time the machine is available to run, ie is not stopped for any breakdown or material or tooling issues etc.

The Planned production time is the total shift time for the machine less any planned stoppage. i.e for planned maintenance, warm up, clean down, lunch breaks etc.

The Planned cycle time is the projected time to produce one part. This normally would be the CNC machining time plus the loading and unloading time for each part.

The Actual cycle time is the time the machine was producing parts divided by the total number of parts produced (scrapped parts included).

The quantity of good parts is simply the number of parts produced that would pass inspection; this is the total number of parts produced minus the number of scrapped parts.

Each figure has to be available for each job on each machine for the OEE calculation to be carried out correctly.

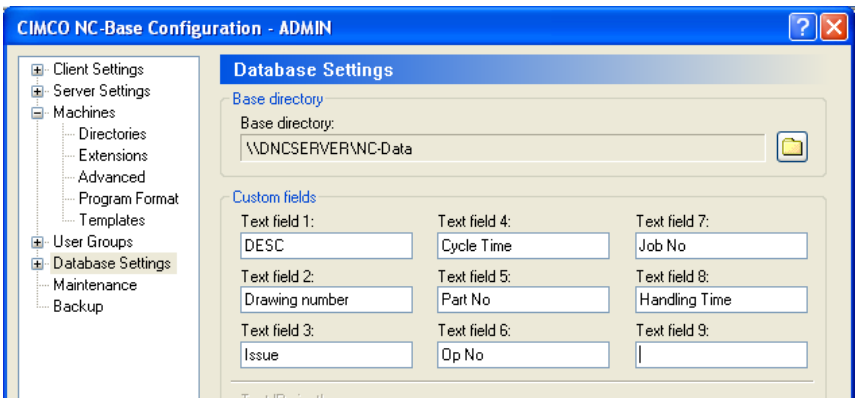
The machine stoppages need to be entered into the database by the operators, normally using a bar code reader, to signal the reason each time the machine tool stops. And the planned cycle and handling times must be entered either into the Cimco database, or into an Excel spreadsheet.

13.1 OEE Reports - Cycle Times provided by NC-Base

Nc-Base must be set up to record the projected cycle time and handling time for each job, this means these fields must exist already in the database or we have to add them.

13.1.1 Adding Cycle Time and Handling fields to NC-Base

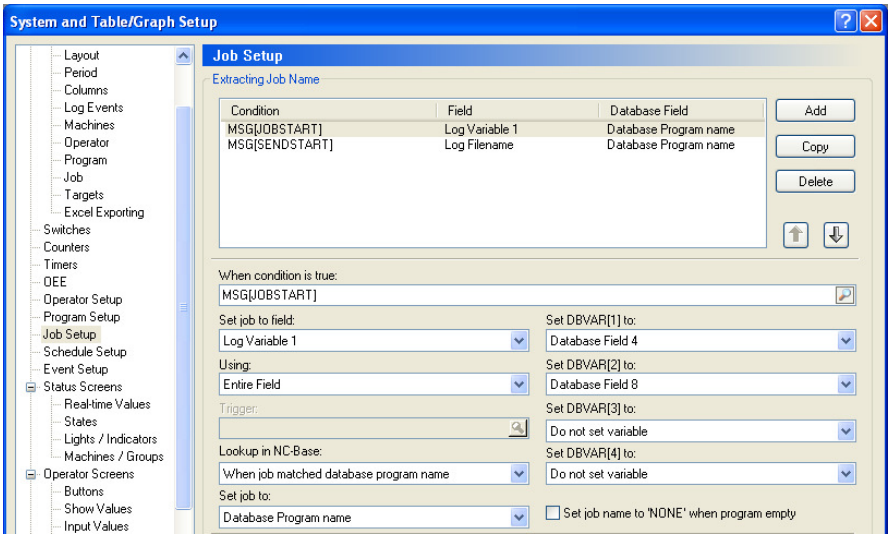
Open Cimco Edit, Click Database, Setup and highlight Database Settings on the left.



Most NC-Base databases already have a Cycle Time field so we have to add an extra Handling Time field. In the example above the Cycle Time was already an active field. The Handling Time field was added later. DO NOT change the field order on an existing database as this will leave all existing data fields with the incorrect data in them. Add an extra field at the end of the existing database fields to avoid corruption. Click OK to save the changes. Keep a note of which database field the Cycle time and Handling time are saved in – you will need them in the next stage.

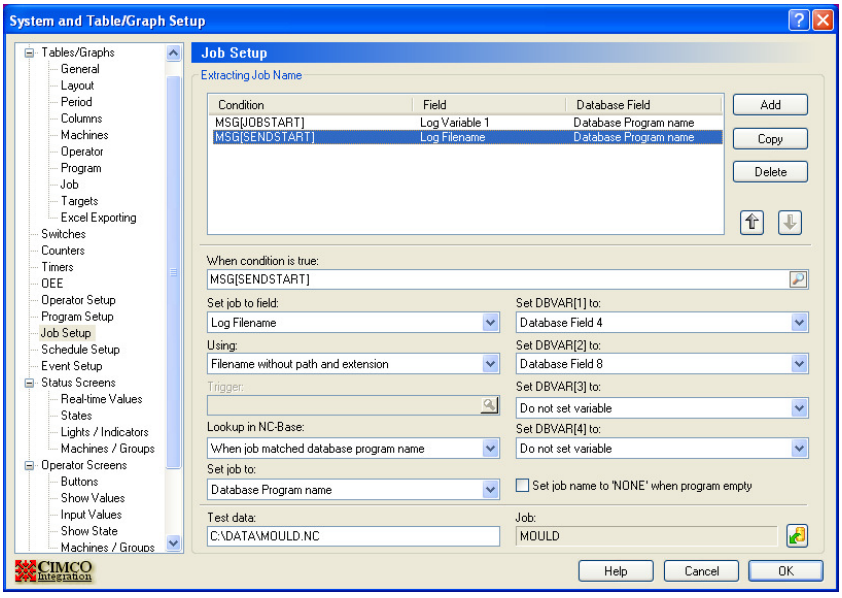
13.1.2 Configuring MDC-Max to use NC-Base fields

We now need to configure MDC-Max to look at these fields. Open the MDC-Max client, click Setup, System Setup and click Job Setup on the left.



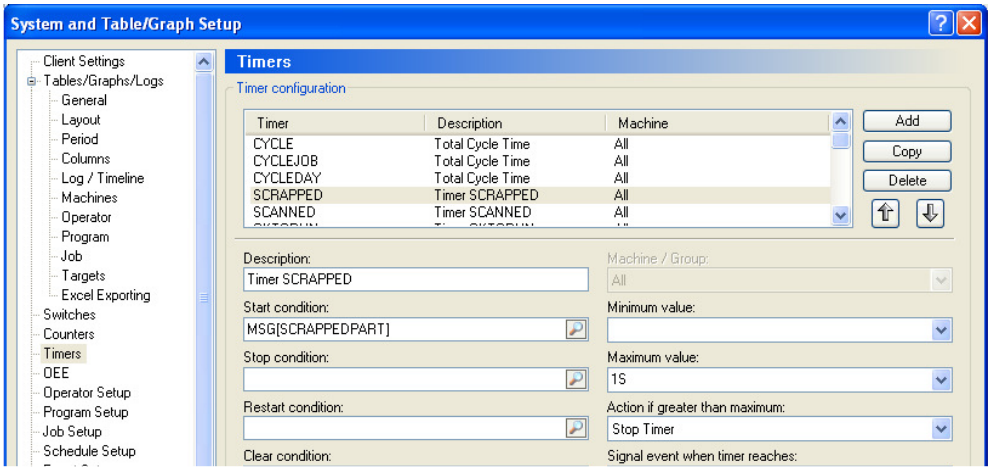
Click MSG[JOBSTART] in the list (this is the barcode start job message we setup previously). Now click into DBVAR section on the right – these variables will be used to read the correct database fields in NCBase. Set DBVAR(1) to be the Cycle Time (Database Field 4 in our example) and DBVAR(2) to the Handling time (Database Field 8 in our example). Note you can now use DBVAR(1) on any live screen to display the expected cycle time.

Click MSG[SENDSTART] and make the same changes to it. This ensures that the database variables are read whether using a barcode reader or sending a file from DNC-Max.



13.1.3 Configuring a scrap counter timer for MDC-Max

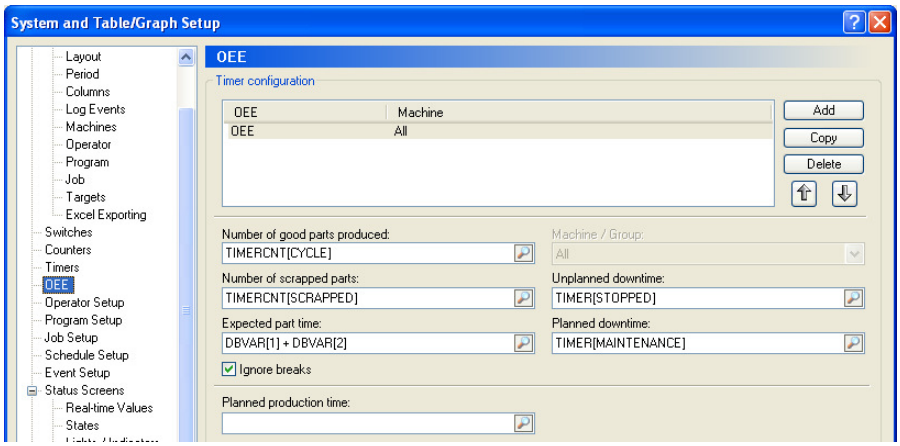
OEE requires that we record the number of scrapped parts. This means we must setup a timer to count the number of times the operator scans a ‘Scrapped part’ bar code.



The start condition is the SCRAPPEDPART message (which you will need to setup in DNC-Max) and the maximum value is 1 Second (1 second). Note that this will only work if the operator scans scrapped parts while he is running the same job.

13.1.4 Adding Cycle time to MDC-Max OEE configuration

Next call up the OEE menu and enter the value for the expected part time. This is the sum of the two DBVAR values configured in the last section (i.e the sum of Cycle Time and Handling Time from the database.

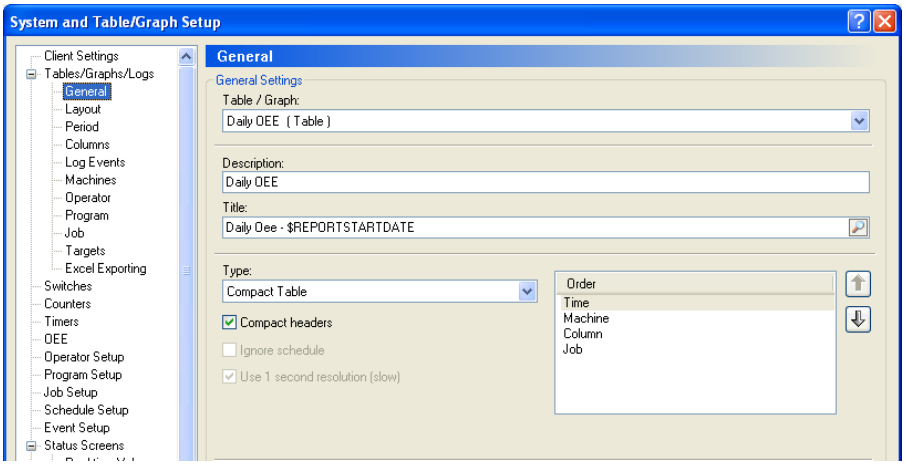


13.1.5 Adding Part/Scrap Count and Production time to OEE

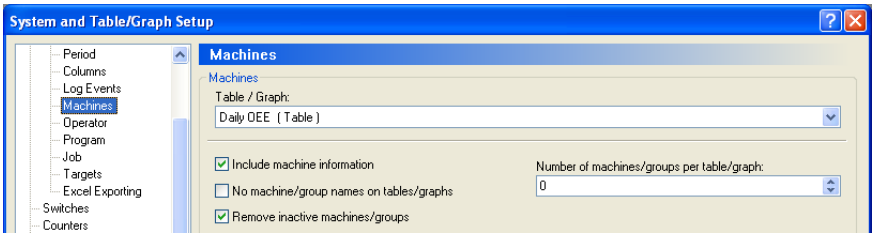
The other field values then need to be entered to enable the calculations. The number of good parts is the total part count. The number of scrapped parts comes from the timer we just set up. In this case we are using the ‘Stopped’ timer to record the unplanned downtime and the ‘Maintenance’ timer to record planned downtime. If we leave the Planned Production Time blank it will use the shift pattern entered in the schedule setup to calculate this figure.

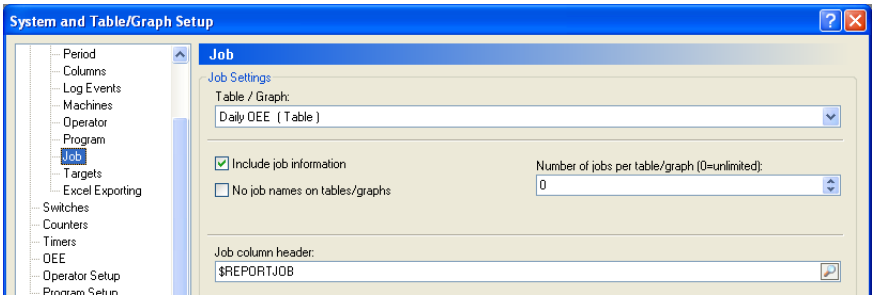
13.1.6 Creating the OEE Table

An OEE table can now be produced to display the daily OEE figure. First generate a new table called Daily OEE (click Tables/Graphs on the left and Add a new Table).



Select Compact Table from the type and tick Compact headers, this will make the data clearly readable on the resultant chart. The machine and job information should also be included using the tick boxes in the two respective menus (see below) and set in the order shown above.

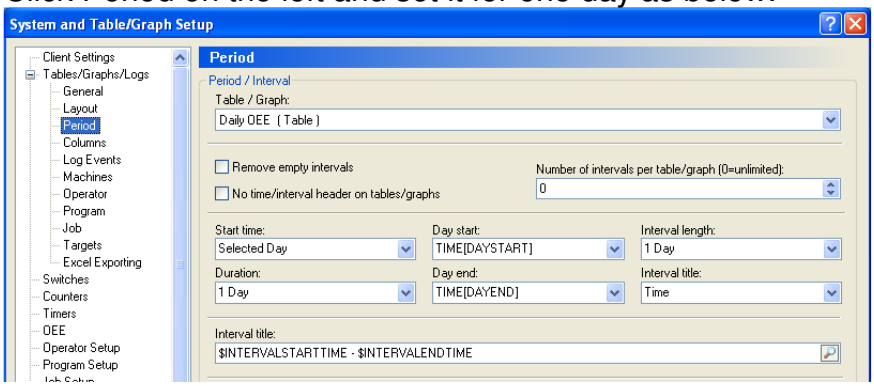




Make sure that the ‘Number of jobs per table/graph’ and ‘Number of machines/groups per table/graph’ boxes are both set to 0 and that the ‘Remove inactive machines/groups’ box on the machines menu it ticked.

13.1.7 Setting the OEE Table Period

Click Period on the left and set it for one day as below:-

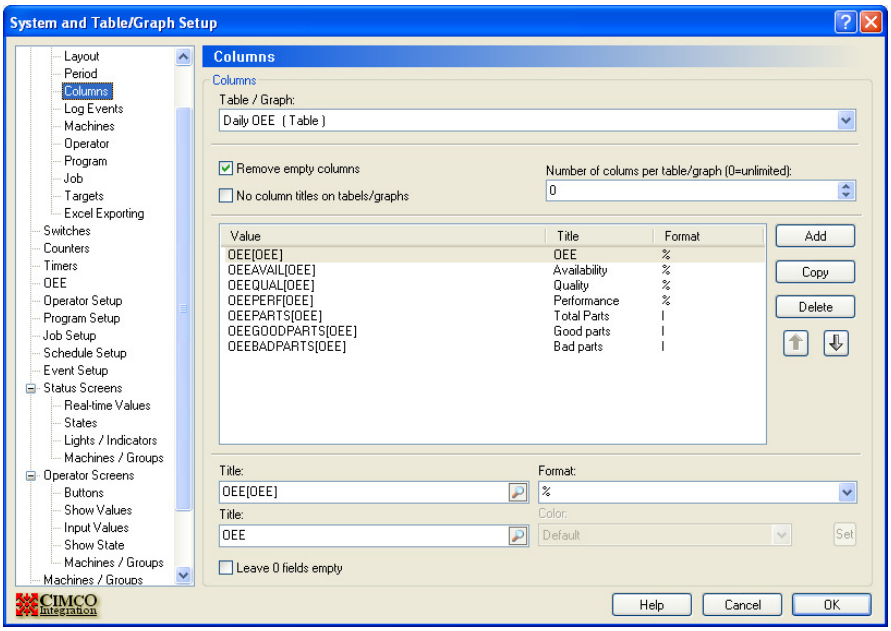


In this example we are producing a table for a whole day, so the interval length should also be set to one day. It is however possible to produce a table showing OEE on an hourly or shift by shift basis simply by changing the Interval Length to 1 hour or 1 shift accordingly.

13.1.8 Adding the OEE data

Click Columns on the left, tick the 'Remove empty columns' box.

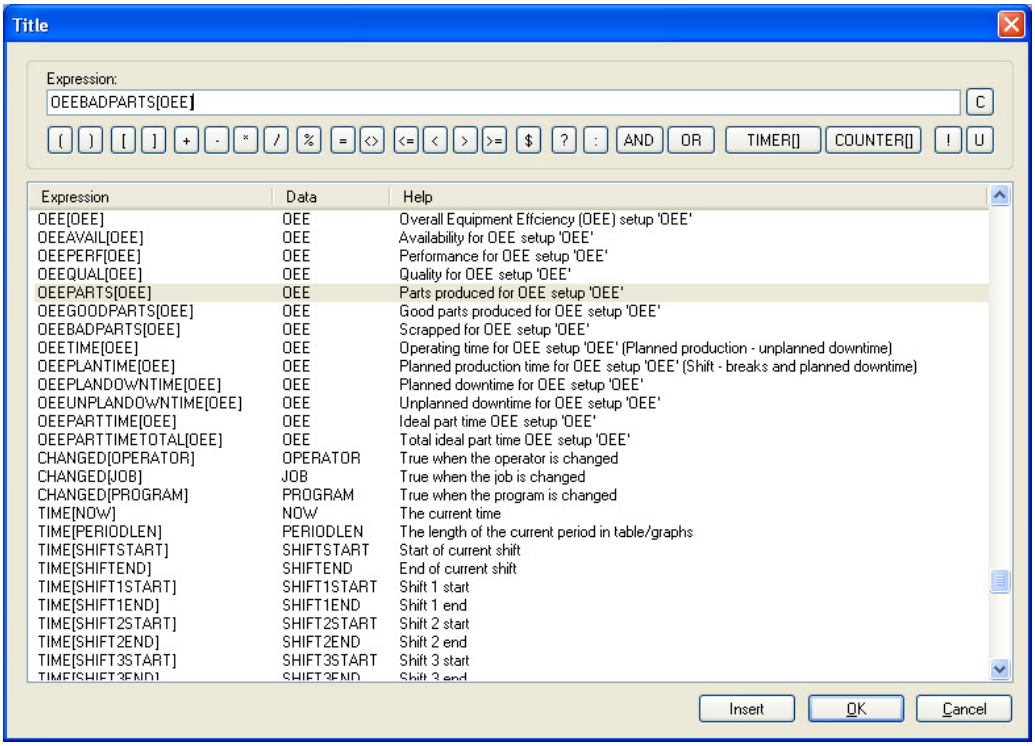
Add each of the following values in sequence using the search icon, the OEE values are near the bottom of the list of expressions just above the TIME options. The order of the columns determines the order they will be displayed in the resultant table. The order can be changed by highlighting a value in the central window and moving it up and down the list using the up and down arrows to the right of the window.



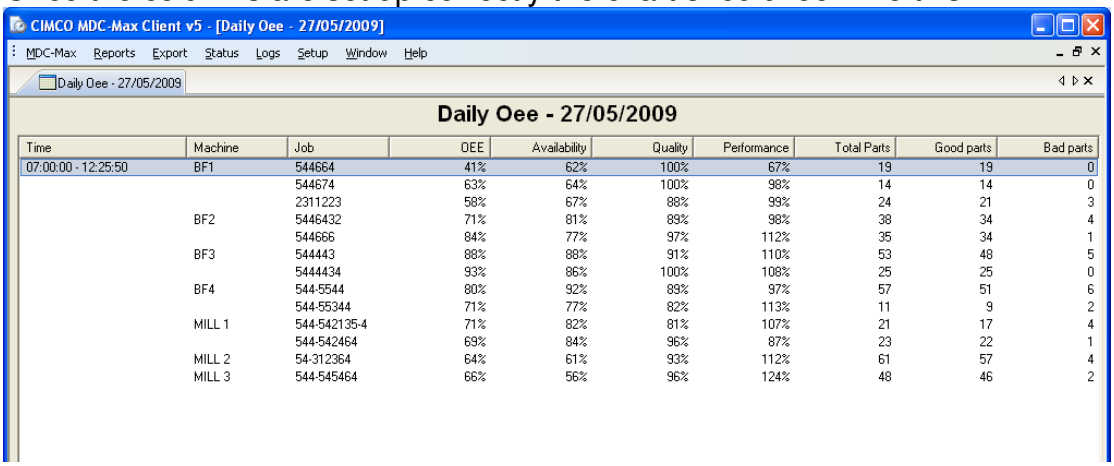
The title for each value will appear at the top of the chart and needs to be manually entered for each value. The formats also need to be set correctly or

the data will be displayed incorrectly, as a guide the OEE expressions are all in '%' format apart from the Part counts which are 'I' Integers and the time's are all 'HMS' format.

OEE Values:-



Once the columns are set up correctly the chart should look like this:-

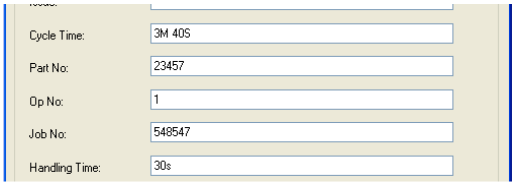


Time	Machine	Job	OEE	Availability	Quality	Performance	Total Parts	Good parts	Bad parts
07:00:00 - 12:25:50	BF1	544664	41%	62%	100%	67%	19	19	0
		544674	63%	64%	100%	98%	14	14	0
		2311223	58%	67%	88%	99%	24	21	3
	BF2	5446432	71%	81%	89%	98%	38	34	4
		544666	84%	77%	97%	112%	35	34	1
	BF3	544443	88%	88%	91%	110%	53	48	5
		5444434	93%	86%	100%	108%	25	25	0
	BF4	544-5544	80%	92%	89%	97%	57	51	6
		544-55344	71%	77%	82%	113%	11	9	2
	MILL 1	544-542135-4	71%	82%	81%	107%	21	17	4
		544-542464	69%	84%	96%	87%	23	22	1
	MILL 2	54-312364	64%	61%	93%	112%	61	57	4
	MILL 3	544-545464	66%	56%	96%	124%	48	46	2

Any performance figures greater than 100% show that the part is being produced in less time than the database expected time figures, less than 100% shows it is taking longer to produce than the expected time.

13.1.9 Entering Cycle and Handling Times in NC-Base

The performance figure will only be calculated if the relevant fields were filled in for the job in the database. Open Cimco Edit, click the database icon to see a list of files and double click a filename to display the Job stats:-



The Cycle Time and Handling Time fields should be entered either as a number of seconds or in the form 3M 40S for 3 minutes 40 seconds. The Data in these fields is read by MDC-Max as each new job starts, so retrospectively adding the Cycle Times will have no effect on the OEE figures until the job is run again.

13.2 OEE Reports - Cycle Times provided by Excel

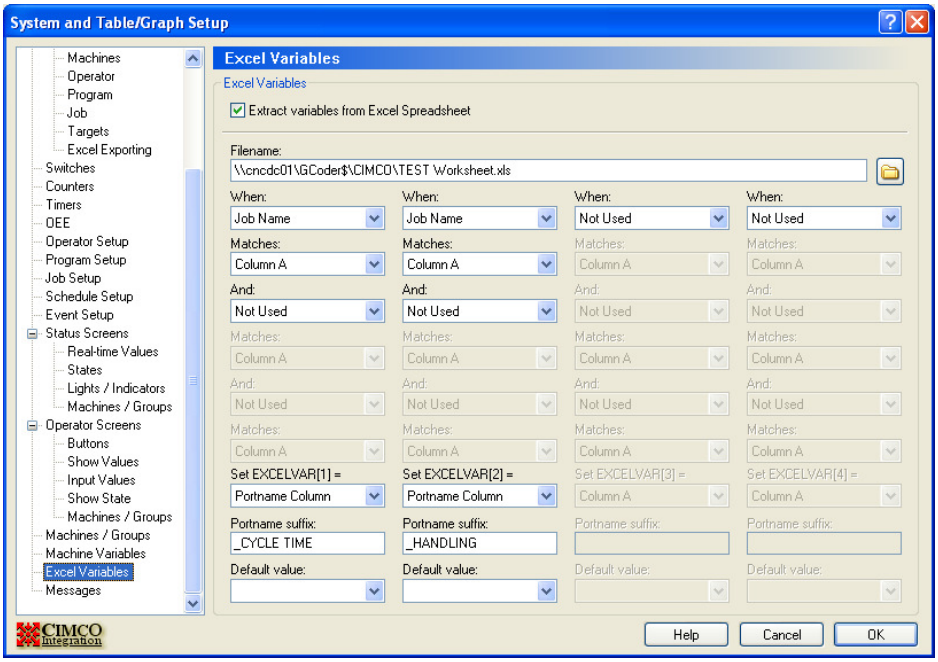
An alternative to using the database is to use an excel spreadsheet to store the times for each job. The data should be stored in an excel spreadsheet similar to the one below.

JOB No	BF1_CYCLE TIME	BF1_HANDLING	BF2_CYCLE TIME	BF2_HANDLING
1111223	20	20		
2311223	132	20		
544666			230	65
5444434			300	20
544-5544			200	25
544-542135-4			176	30
54464	130	25		
544674	120	33		
2311223	123	55		
544664	220	75		
5446432	33	33		
544443			234	30
544-55344			330	25
54-312364			120	75
5446-543	145	120		
5446-5574	150	45		
544-545464			126	39

In this example the cycle time and handling time for different machines are entered in seconds (BF1 and BF2 are the names of the machines as entered in DNC-Max as port names). This format is flexible as it allows the same job to have different runtimes on different machines.

NOTE: For the excel interface to work the PC running the DNC-Max server must have the MS Excel library functions loaded – the simplest way to do this is to install a copy of Excel.

Open MDC-Max client, Click Setup, System Setup and Highlight Excel Variables on the left.



Tick the “Extract Variables from Excel” box.
The filename must point to the name of the excel spreadsheet containing the data (always use a UNC name rather than a mapped drive as each MDC-Max client must be able to access the spreadsheet).

In the example above, in the first column on the menu, when the ‘Job Name’ changes for any machine, MDC-Max looks for a match in Column A of the spreadsheet.

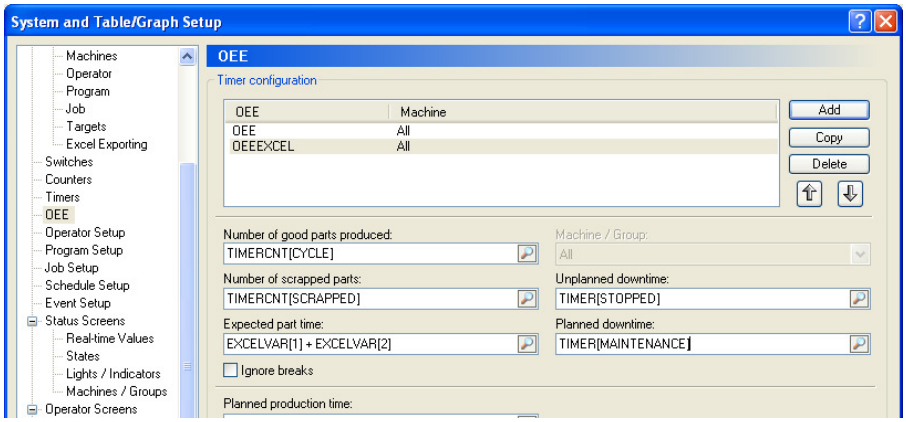
If MDC-Max finds a match it then appends _CYCLE TIME to the DNC-Max Portname and sets EXCELVAR(1) to the value in the same row whose column is called PortName_CYCLE TIME.

MDC-Max then matches the second condition and sets EXCELVAR(2) to the value in the same row which matches PortName_HANDLING.

For example if the jobname changes to 54464 on machine BF1
MDC-Max looks for 54464 in Column A and finds it.
It then creates column reference BF1_CYCLE TIME and finds the value 130 in the BF1_CYCLE TIME column for the 54464 row.
EXCELVAR(1) is set to 130
MDC-Max then checks the second condition (When Jobname matches) and finds 54464 in Column A
It then creates column reference BF1_HANDLING and finds the value 25 in the BF1_HANDLING column of the 54464 row
EXCELVAR(2) is set to 25

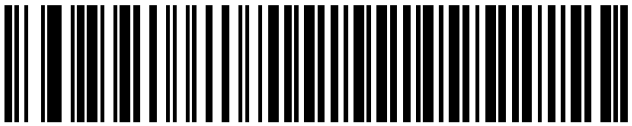
The best way to check the configuration once complete is to set up a simple operator screen with a jobname input field and to display the values of ‘EXCELVAR (1)’ and ‘EXCELVAR (2)’ on the same screen. Test the variables by entering different jobnames or numbers and checking the values displayed. You can also use EXCELVAR(1) on normal live screens to display the expected cycle time for a given job.

Click OEE on the left menu and fill in the OEE values as follows :-



The system will now look at the Excel spreadsheet for its part cycle times. Create the chart in exactly the same way as for NC-Base (section 13.1.5 onwards).

Appendix A - LS2208 Barcode Setup Sheet

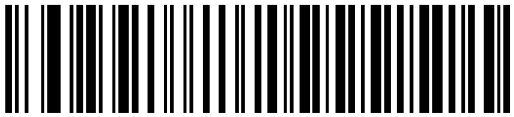


SCAN THIS CODE FIRST

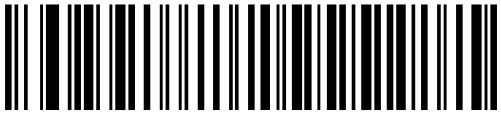
Standard RS-232[1]

THEN SCAN ONE OF THE BAUDRATE SETTINGS

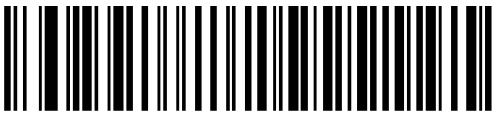
Baud Rate 600



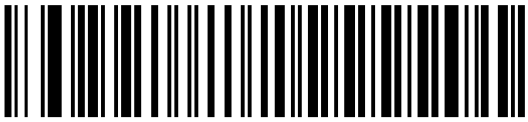
Baud Rate 1200



Baud Rate 2400



Baud Rate 4800



***Baud Rate 9600**

Baud Rate 19,200

Baud Rate 38,400

SCAN ONE PARITY SETTING

Odd

Even

***None**

SCAN EITHER 1 or 2 STOPBITS

***1 Stop Bit**

2 Stop Bits

SCAN EITHER 7 or 8 DATABITS

7-Bit

***8-Bit**

SCAN EACH

Scan Options

OF THESE

<DATA> <SUFFIX>

THREE BARCODES IN ORDER

(THIS ADDS A CRLF AFTER THE SCAN OUTPUT)

Enter

Appendix B – Example Bar Code Sheet

SETTING

TOOLING

INSPECTION

MAINTENANCE

BREAKDOWN

MATERIAL

NO WORK

NO OPERATOR

OK TO RUN

START NEW JOB

Sample Job Numbers For Testing Purposes

2311223

544666

544443

544-542135-4