

# Grrsetup Macro Instructions

## What is it?

This macro will quickly setup a Gage R&R study in the active Minitab Worksheet. You will need to specify 4 columns where the design will be placed (Sample, Operator, Trial & RunOrder). The run order will be randomized within each trial, and will continue numbering from one trial to the next. You need at least 2 trials.

## How do I install it?

To install the macro, locate the Minitab root directory (MTBWIN), which is usually found here C: \ Program Files \ MTBWIN. Within the Minitab root directory, there is a directory of macros (MTBWIN \ Macros). Place a copy of the GRRSETUP.MAC file into that directory. You are now ready to run the macro.

## How do I run the GRRSetup Macro?

Start Minitab. Be certain to activate the session window (Click in it or type Control-M). Once the session window is on top and active, Go to the Editor menu. There you should select either “Enable Command Language” or “Enable Commands”, depending upon whether you are using version 12 or 13 of Minitab respectively. Select that choice so that a checkmark appears when you go back to the editor menu. You should see “MTB>” at the bottom of the session window.

You are now ready to run the macro.

At the **MTB>** prompt, type “ **%GRRsetup C1-C4;** ” without the quotes. Note that the semicolon is important ! Minitab will respond with the subcommand prompt: **SUBC>** Now we tell the macro how many levels of each variable we want to study. The order is not important, but you must be complete with these entries (Sample, Operator, Trial). See the example that follows. For a 5 sample, 3 operator GR&R study with 3 trials you will have the following in your session window after typing in the proper entries:

```
MTB>%grrsetup C1-C4;  
SUBC>sample 5;  
SUBC>operator 3;  
SUBC>trial 3.
```

Upon entering the last command (with the period), the macro will run. You will get the following output:

```
Executing from file: C:\MTBWIN\MACROS\grrsetup.MAC
```

```
This macro sets up a GRR study in your worksheet  
Macro is running ... please wait
```

```
Worksheet setup with 5 Samples, 3 Operators and 3 trials
```

```
Samples have been randomized within each operator and trial
```

```
GRRsetup macro execution completed.
```

```
MTB >
```

## Options & Precautions

### **Randomization:**

There are 2 randomization schemes possible with this macro.

The default method randomizes samples for each operator within each trial according to suggested AIAG guidelines. In other words, each operator sets-up the measurement system, then randomly goes through all the samples once for each trial. In this way, set-up error biases will be assigned to each operator if they offset the average reading. However, if an operator's process has measurement set-up variability, it will not likely be captured with this randomization scheme, since each operator sets up the gage only once per trial.

Full Randomization option – The macro also allows you to fully randomize both operators and samples within each trial. This method is more time-consuming to conduct, and will require each operator to reset the gage a random number of times. In this method, set-up variability is now included with the repeatability variance component. To activate the full randomization scheme, simply conclude the macro subcommands as follows:

```
MTB>>%grrsetup C1-C4;  
SUBC>sample 5;  
SUBC>operator 3;  
SUBC>trial 3;  
SUBC>fullrand.
```

A sample of the worksheet with full randomization follows on the following pages.

### **Precautions:**

The macro requires at least two trials. Otherwise you cannot estimate a repeatability variance component.

The macro will not work with more than 20 trials. We had to limit the number to a reasonable quantity for macro memory management. 20 trials seemed like a large enough upper bound. If you need more than 20, you can always set-up the worksheet manually.

The macro will not work with samples\*operators > 100. This is again a limitation based on macro memory conservation, not a Minitab restriction. If you need more, then you can set up the worksheet manually.

Now let's go evaluate and then improve our measurement systems!

**What the output looks like with default randomization:**

<u>Samples</u>	<u>Operator</u>	<u>Trial</u>	<u>RunOrder</u>
1	1	1	4
2	1	1	1
3	1	1	3
4	1	1	2
5	1	1	5
1	2	1	9
2	2	1	8
3	2	1	7
4	2	1	10
5	2	1	6
1	3	1	14
2	3	1	12
3	3	1	11
4	3	1	13
5	3	1	15
1	1	2	17
2	1	2	16
3	1	2	18
4	1	2	19
5	1	2	20
1	2	2	21
2	2	2	25
3	2	2	23
4	2	2	22
5	2	2	24
1	3	2	30
2	3	2	29
3	3	2	26
4	3	2	27
5	3	2	28
1	1	3	31
2	1	3	34
3	1	3	35
4	1	3	32
5	1	3	33
1	2	3	40
2	2	3	38
3	2	3	39
4	2	3	37
5	2	3	36
1	3	3	44
2	3	3	41
3	3	3	45
4	3	3	43
5	3	3	42

**What the output looks like with full randomization:**

<u>Samples</u>	<u>Operator</u>	<u>Trial</u>	<u>RunOrder</u>
1	1	1	7
2	1	1	9
3	1	1	8
4	1	1	11
5	1	1	5
1	2	1	15
2	2	1	10
3	2	1	1
4	2	1	14
5	2	1	2
1	3	1	12
2	3	1	13
3	3	1	6
4	3	1	3
5	3	1	4
1	1	2	30
2	1	2	17
3	1	2	23
4	1	2	26
5	1	2	28
1	2	2	18
2	2	2	29
3	2	2	25
4	2	2	19
5	2	2	20
1	3	2	24
2	3	2	16
3	3	2	22
4	3	2	27
5	3	2	21
1	1	3	43
2	1	3	36
3	1	3	44
4	1	3	42
5	1	3	35
1	2	3	40
2	2	3	38
3	2	3	34
4	2	3	32
5	2	3	31
1	3	3	33
2	3	3	37
3	3	3	45
4	3	3	39
5	3	3	41