

MF300Fm+
FERRITE METER

USER MANUAL

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- PREFACE
- INTRODUCTION
- FIRST TIME
- QUICK START
- OPERATION
- FERRITE PERCENTAGE
- SOFTWARE
- SPECIFICATION
- LOW BATTERY
- LIABILITY
- CALIBRATION & REPAIR
- DISPOSAL & RECYCLING

Thank you for purchasing the Ferrite Meter. Before using the unit, please read these instructions carefully. If you are uncertain about any aspect of its operation, please contact Diverse, our contact details are at the end of this manual.

The MF300Fm+ is the latest version of the Diverse Ferrite Meter. It has a large number of features including:

- Robust slimline probe
- Choice of up to 5 probes used interchangeably
- Five individual transfer calibration standards
- Peak measurement mode
- User calibration
- 1000 records including user specified IDs
- Backlit display
- Large character mode

Options include:

1. Standard 10 mm diameter probe (P10), air-cooled probe for hot samples (P10ac) or small 4 mm x 6 mm probe (P46 or P46R)
2. Maximum 2 x P10, P46, P46R and 1 x P10AC. NB must be specified at order and supplied calibrated with instrument
3. Serial software for download to PC (RS232/USB)

Industrial processing and chemical plants work at high temperatures and pressures, with often aggressive media and stainless steel is often the material of choice for these applications. If the ferrite content of the steel is too low, then welding of stainless material may crack at elevated temperature or with high stress or vibration. Alternatively, if the ferrite content is too high, the weld may be weaker and corrode.

To address the need to measure the amount of ferrite in a sample the Welding Research Council introduced the *Ferrite Number* (FN) as standardised value which related to the ferrite content of an equivalently magnetic weld metal.

The volume percentage of ferrite can be estimated as about 70% of the FN but the relationship depends upon the type and origin of the stainless steel used and the measurement technique (see section on Ferrite %)

The Diverse Ferrite meter MF300Fm+ measures the Ferrite number (FN) of austenitic and duplex stainless steel weld material. It has a choice of probes: e.g. see



image for P10 probe that is sensitive to ferrite content in a 10 mm area to a depth of approximately 1 mm. The instrument is calibrated using the secondary ferrite number standards prepared by the National Institute of Standards and Technologies (NIST) in USA. Sixteen standards are used ranging from 0.5 to 111.9 FN giving an instrument with a measurement range from 0 to 115 FN. Transfer standards are supplied with the instrument allowing performance to be verified at any time.







The MF300Fm+ Ferrite Meter is supplied in a red carry case with 5 transfer calibration standards. The Meter is calibrated within a few weeks of despatch with probes as specified and supplied with calibration certificates. The veracity of the instrument can be checked at any time using the transfer standards. The unit requires 4 AA cells which should be installed in the battery compartment on the rear of the housing.



The sensitive region of the probe is the flat silver area at the probe end.

If you have chosen the serial RS232/USB interface version, you should:

- Load the USB driver onto your computer using the CD supplied
- Download the serial software from:
<http://www.diverse-technologies.net/software/magmeterserial.zip>
- Unpack the files into a directory. To run the software click on MagmeterSerial.exe (for convenience we recommend you make a shortcut on your desktop)

1. Plug in the ferrite probe.
2. Load four AA batteries in to the battery compartment ensuring that the polarity is correct.
3. If you have the gas cooled option and are using hot samples connect a gas/air-line, regulated to 2 bar, to the probe using the fitting provided.
4. Press the power key , the unit will switch on. The probe type will be displayed on the top line.
5. Hold the probe away from magnetic material and press the tick key . This will zero the probe. The P46 probe is very sensitive and will detect the earth's field so zero the probe in the same orientation as the measurement.
6. Move the probe to sample to be measured, the FN is displayed.
7. Press and hold the up key  to toggle between FN and ferrite percentage. Note that the ferrite percentage displayed is calculated using a conversion graph (see section on 'Ferrite Percentage').
8. Pressing the tick key  to access the menu (including user calibration, transfer standard mode and logging, see later for details).
9. Press the power key  to store the current measurement (see section on 'Recording a new record into the database' for details)
10. Press and hold the power key  to switch the instrument off. If the instrument is not used for a period of about 5 minutes it will automatically switch off to preserve battery life.

The Ferrite meter has 4 keys:

ⓘ power ✓ tick ▲ up ▼ down

The ⓘ power, ✓ tick, ▲ up and ▼ down keys have a second meanings if held down for more than 2 seconds. The step by step instructions that follow provide all the key information about operation of the instrument.

Step 1 Plug in the Ferrite Probe

Step 2 Power On/Off

Switch the unit on by pressing the ⓘ power key. The display shows a splash screen followed by 'zeroing..' for a second and then then the value of FN. This should be 0.0 FN. To switch the unit off press and hold ⓘ power key for 2 seconds. The screen will show 'Power off' before going blank

Step 3 Zero

The zero reading of the meter should be adjusted before taking readings. Hold the probe away from magnetic material. The display should show 0.0 FN. If not, press ✓ tick. The display will indicate 'zeroing..' then the display should show 0.0 FN. The probe can now be used to take measurements. The reading can be zeroed in this way at any time. For the P46 probe ensure the probe is zeroed in the same orientation as will be used for the measurment.

Operation - Display Options

Step 4 Display Options

4.1 Top line

4.1.1 Record number

On the top line the number of the next available record in the database is displayed on the left.

There are 1000 available records (0-999) and the current measurement value can be saved by pressing the ⓘ power key.



4.1.2 Probe type

On the top line middle the probe type will be displayed. Either P10, P10-1, P46, P46R, P10AC

4.1.3 Mode

On the top line, at the right, the mode is displayed. There are three options, AVG, PEAK and TRAN. In AVG the value of FN (or F%) will continuously be updated. In PEAK mode the largest measured value will be displayed, press ✓ tick to start afresh. Press the ▼ down key to toggle between the AVG and PEAK modes. For TRAN see section 4.3

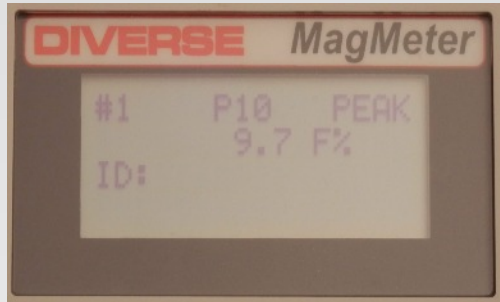
4.1.4 Calibration

If the user calibration is being used then a 'U' will be displayed on the top line to the right of the record number. When the 'U' is not displayed the factory calibration is being used. For details on user calibration see section 5.2

Operation - Display Options continued

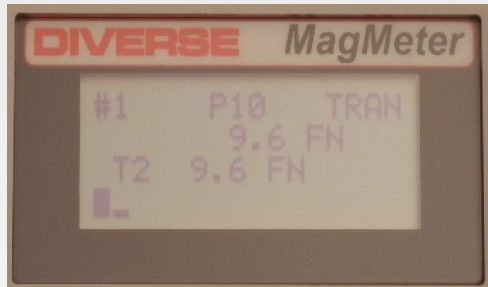
4.2 Second line

On the second line the current measured value is displayed. This value will be displayed as FN or F%, to toggle between these units press and hold the ▲ up key. Note that the instrument is calibrated using FN standards and that the reported F% is calculated using a conversion graph (see section on Ferrite percentage)



4.3 Third line

The third line will show the ID for the next record in the database unless the transfer calibration mode has been selected (See section 5.3). In this mode the value (FN) will be displayed on the second line (as usual) but the expected value for one of the transfer standards will be shown on the third line. To cycle through the transfer standards use the ▼ down key. This mode facilitates checking the veracity of the instrument.



4.4 Bottom line

The bottom line has a bar graph which shows the current value graphically where a full bar corresponds to full scale (115 FN).

Operation - Display Options continued

4.5 Backlight

Double press the
▼ down key to
toggle the display
backlight on and
off. Note that the
extra power
consumed by the

backlight will result in an increase in the battery discharge rate.



4.6 Large character mode

The main reading can be switched into large characters using a double press of the ▲ up key. This double press will toggle between the standard and large character display. The large character mode uses the bottom 3 lines of the display; as such the the transfer standard value will not display in TRAN mode nor will the bar graph on the bottom line.



Step 5. Menu

To access the menu press and hold the ✓ tick key. Use the ▲ up or ▼ down keys to move between the options and ✓ tick key to access a particular option.

5.1 Select factory/user calibration (Cal F/U)

The instrument can be operated with the factory calibration or a user calibration. Press the ✓ tick key to select between these two options. Press the ▲ up or ▼ down keys to toggle between the two options, ✓ tick selects and Ⓟ power to abandon

5.2 New user calibration (New cal)

This option allows a user calibration to be performed. A user may opt for this if the transfer calibration standards are not measuring accurately. If the transfer standards do not read accurately after a user calibration then the instrument should be returned to Diverse for factory calibration. Press ✓ tick key to select user calibration. The screen will show 'zeroing..' and then request user to place probe onto the centre of T0 sample and press tick. The instrument will display the factor used for user calibration (a factor of 1.0 indicates no change from factory calibration).

5.3 Transfer calibration mode (Trans)

This allows selection of the transfer calibration mode (for description see 4.3 Third line).

Operation - Menu continued

5.4 View data log (Viewlog)

This displays the log of saved ferrite records, 4 records per screen. To cycle through the records use the ▲ up or ▼ down keys, long press ▲ up or ▼ down keys to move 100 records, any other key to leave. Note, the next record pointer will be updated to the record number at the top of the last viewed log page.

5.5 Clear data log (ClrLog)

This option will set all of the records to 0.0 FN and clear all of the record IDs. The next saved record will revert to #0. Note this will take some time, a progress bar is displayed

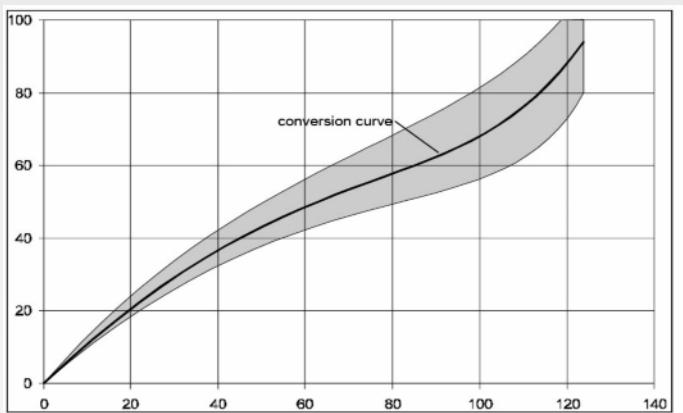
5.6 Serial download (Serial)

If you have the serial option readings from the instrument can be output to a computer via a serial link. This can be RS232 or USB. Connect the instrument to the PC using the cable provided. See section for operating the serial software.

Ferrite Percentage

Calibration standards exist for ferrite number (FN) and the MF300Fm+ is calibrated using secondary ferrite number standards supplied by NIST. The volume percentage of ferrite can be estimated roughly as about 70% of the FN particularly at higher FN (ref 1). However, the relationship depends upon the type and origin of the stainless steel used and the measurement technique.

MF300Fm+ measures FN but can display ferrite percentage (toggle between display modes using a long press on the ▲ up key). Ferrite % (y-axis) is calculated from FN (x-axis) using the following conversion curve (ref 2).



Using the results of measurements on reference standards the conversion relationship shown was determined. The measurement converted to point count ferrite shows an uncertainty of $\pm 16\%$ of the measurement (indicated by the grey area above and below the conversion curve).

Ref. 1 MF300Fe+ with software versions prior to 271117 use $0.7 \times FN$ for ferrite percentage

Ref. 2 Operating Manual FERITSCOPE MP30 (2.0 - 12/01)

Software

The serial version of the MF300Fm+ is supplied with software to run on a windows (10/7/Vista/XP/2000) PC, see First Time for information about installation. The program name is: MagmeterSerial.exe. Its operation is as follows:

Download files from:

<http://www.diverse-technologies.net/resources/software/magmeterserial.zip>.

Unpack and copy all the files to the directory in which you want to work (there is no separate installation file). Generate an icon for the program on your desktop by right clicking the desktop, then select New, Shortcut and navigate to where you placed the .exe file. Run the program by either clicking it on the desktop icon, or selecting it in file manager.

The first time you use it, you should identify the communications port you wish to use, the program provides you with a list of possible ports. The chosen port is stored in the configuration file and will be automatically selected next time it's run. Connect the MF300Fm+ to the computer serial port. If your computer only has USB ports you will need the USB to serial adapter cable supplied. Ensure the MF300Fm+ is switched on. On the software, select start: this will open the communications port and get the MF300Fm+ to identify itself on the listbox on screen. Pressing the space bar will cause the current reading to be transmitted to the PC and it will be displayed. Use file save to save the results to a text file which can be directly imported into Excel or Open Office.

From the computer the following functions are available:

Key	Function
Enter	Download current reading
Spacebar	Download current reading
B	Display battery voltage
D	Download database
E	Download EEPROM
I	Display meter type
V	Display meter software version

NB Letter keys must be uppercase

Once you have completed the data collection, select Stop, and the system will inform you that the communication port is closed. If you do not want to use the logging software provided, then you can use any serial terminal software such as Hyperterminal supplied free with Windows XP. Free updates to the logging software are placed on our web site:

<http://www.diverse-technologies.net>

Software - MF300Fm+

The instrument provides for storage of up to 1000 sample records. Each record is accompanied by a 4 character ID which is used to identify the place where the measurement is taken. If you do not want to use the ID then on sampling the sample number is used.

The serial interface is upgraded to 19200 Baud allowing for quicker downloads of the full database.

Records are stored as a fixed field format: xxxyyyyyFNzzzz

where xxx is the record number 000 - 999

yyyyyFN is the ferrite number 000.0 - 115.0

zzzz is the ID for user z is any alphanumeric character

From the computer the following additional functions are available:

Key	Function
Pnnn	Moves the record pointer to nnn: 000 - 999
C	Clear the database (only available from other terminals, use drop down menu for this function with MF300Fm+ serial software)
R	Download record at current pointer and increment pointer
S	Get status from the instrument - used during transfers to ensure new commands are not sent before the last one finishes.

Recording a new reading into the database

Make a short press of the ⓘ power key. A new line will be displayed at the bottom of the screen.

This will display the current record number on the left, the Ferrite measurement value to be stored and the record ID. If the record ID was previously empty then this will default to the current record number, otherwise it will be the record ID currently stored in the database.

The cursor will be flashing over the first character of record ID.

Use the ▲ up or ▼ down keys to select character (0-9, space or A-Z).

Use the ✓ tick key to go to the next position in the record ID.

Use a long press of the ✓ tick key to store the record. The next record number will be displayed on the top line.

If you do not wish to save the record make a short press of the ⓘ power key. The instrument will confirm record has not been saved.

Note to move the next saved record to a particular record number use the PC software. Alternatively use viewlog on the instrument to get to a multiple of 4 (i.e. 0, 4, 8 etc.) and then use the up key ▲ to advance the record number (displayed at the top left). The ID for this record will be displayed on the left line (provided not in Transfer calibration mode).

Database control in Windows software

The actions are controlled by the menus and the ribbon of buttons.

Button ID Function

Start Opens the communication port and establishes connection provided hardware set-up and correct port selected

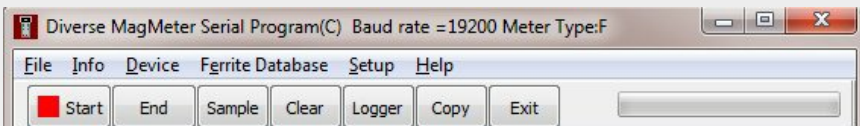
End Closes current connection

Sample Request sample from meter

Clear Clears received data window

Logger Opens the logger controls for timed download

Exit Close serial software



Readings and IDs are downloaded from the instrument to the screen listbox. This can then be saved (*File:save data file*) to a CSV file for export to other data analysis software. Stored files can be recalled (*File:read data file*) to the listbox.

Information about the instrument can be obtained from (*info: Battery/Device/version*).

The connected Magmeter device can be selected (*Device:MF300X*).

Access to the ferrite results database on the instrument is via the *Ferrite Database* menu. There are several options:

- Downloading a group of records, user is prompted for the first and last

record number.

- Upload site IDs, the user is able to upload a database of IDs to the instrument which can be used to prompt the user for specific sites.
- Upload site IDs and ferrite numbers allows the instrument database to be restored.
- Clear the device database.
- Setup. Logger setup allows for timed logging, set comm port allows the software to identify the comm port allocated by Windows, and for the MF300Fm+ the Baud rate should be set to 19200 (all other instruments are 9600 Baud).

MF300Fm+ Specification

Units	Ferrite Number FN or Ferrite percentage F%
Range	0 - 115 FN 0 - 80.5% (percent ferrite)
Resolution	0.1 FN or 0.1 F%
Standard: Accuracy (10°C - 30°C) FN 0 - 10 FN 10 - 30 FN 30 - 100	± 0.5 FN ± 5% of the reading ± 10% of the reading
Air cooled: Accuracy (30°C - 300°C) FN 0 - 10 FN 10 - 30 FN 30 - 100	± 1 FN ± 10% of the reading ± 20% of the reading
Calibration	Factory calibration to NIST standards Up to 5 probe factory calibrations can be stored User calibration with transfer standards
Transfer standards	Five transfer standards Range typically 3 FN to 115 FN
Zero	Automatic on demand
Mode	Average or peak
Storage	1000 records with 4 character record ID (Characters available 0-9, A-Z and space)
PC Download and Upload	Optional RS232 and USB. Functions include download of record or part or entire database and upload of record IDs
Probe P46 Sprung loaded sleeve	Pencil style, 15 mm dia. length 130 mm Sensing area 4 mm x 6 mm
Probe P10	Pencil style, 15mm diameter length 120mm Sensing area 10mm diameter
Operating temperature	Standard 0°C - 40°C Air cooled 0°C - 300°C
Air cooled operation (P10ac)	Air line supply regulated to 1 bar maximum Oil filtered supply desirable Air temperature: ambient (10°C - 30°C)
Humidity	Non-condensing
Weight in case	1.25 kg
Case dimensions	210 x 100 x 45 mm
Support	Call/email Diverse for support for use of the instrument or assistance with unusual application.

If the MF300Fm+ displays the legend "Low Battery" on the bottom row of the display when the batteries are low. When the batteries are low the bar graph facility is not available. Do not use the instrument when the batteries are low as the accuracy may be compromised.

If you are using rechargeable cells then recharge them using a suitable charger. If you are using dry cells replace with 4xAA alkaline cells.

Never use a battery charger with conventional dry cell batteries.

Diverse Technologies accepts no responsibility for the consequential losses arising from the ability or inability to use the equipment supplied. The limit of warranty is the repair or replacement of any faulty components, directly attributable to manufacturing defects, arising during the period of 12 months following purchase. This does not include damage resulting from incorrect operation of the instrument.

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Calibration and repair

The MF300Fm+ and probe or probes is supplied with calibration certificates and transfer calibration standards. If the transfer standards do not read accurately, and this is not rectified by a user calibration (section 5.2), then the instrument should be returned to Diverse for factory calibration.

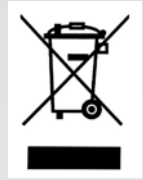
If the MF300Fm+ requires repair, the unit should be returned to Diverse, there are no user serviceable parts.

IMPORTANT

Instruments returned to Diverse for calibration or repair must be imported into the UK using the correct procedure. Contact Diverse for assistance before returning for calibration. If this is not carried out taxes or duties may arise which we will have to charge back.

Disposal and Recycling

This instrument should be disposed of in a responsible manner to allow the components within it to be recycled. The wheelie bin symbol shown here and on the product means that the product is classed as Electrical and Electronic Equipment and should not be disposed with other household or commercial waste at the end of its working life.



The Waste of Electrical and Electronic Equipment (WEEE) directive (2002/96/EC) has been put in place in the EU to recycle products using the best recovery and recycling techniques to minimise the impact on the environment, treat any hazardous substances and avoid landfill. Business users should ensure that this product is not mixed with other commercial waste for disposal.