

User manual for ML2000

General

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1 General

Before you start to use your target system, please read these instructions carefully to enjoy optimum performance and a longer service life. Keep this manual in a safe place for future reference. The availability of particular products may vary by region. Please check with your sales representative.

1.1 Safety, warranty and notices

1.1.1 Notice

Megalink AS reserves the right to make changes or improvements to this document and/or any of the products described in this document without prior notice.

The contents of this document are provided “as is”. Megalink AS assumes no responsibility for any errors that may appear in this document, nor does it make expressed or implied warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Megalink AS shall not be liable for incidental or consequential damages in connection with, or arising out of the use of this document and/or of the products described in this document.

1.1.2 Safety information

1. Read and understand the instructions carefully. Save the instructions for further reference
2. Observe all warnings and instructions marked on the product.
3. Unplug the product from the wall outlet and power supplies before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
4. Do not use this product near water or when you are wet. Only the target unit can be placed in places exposed to light rain, as long as the target connection box is mounted in the dry place with appropriate grounding.
5. Do not place parts of this product on an unstable stand. The product may fall, causing serious injury or damage to the product. Extra precaution must be taken during installation and/or maintenance to avoid the product or parts of the product to fall.
6. Openings in the power supplies are provided for ventilation. To ensure reliable operations of the product and to protect it from overheating, these openings must not be blocked or covered.
7. This product should be operated from the type of power indicated on the marking label. If you are not sure of the type of power available, consult your sales representative or local power company.
8. Do not allow anything to rest on the power cord. Do not locate this product where persons will walk on the cord.
9. Make sure that you don't exceed the fuse rating or the cord ampere reading for power outlets and/or extension cords.
10. Never push objects of any kind into this product through cabinet openings as they may touch dangerous voltage points or other risks.
11. Refer all servicing or repair to qualified service personnel.
12. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - When the power cord or plug is damaged or frayed
 - If liquid has been spilled into the product
 - If the product has been exposed to rain or water (all products except the target units)

- If the product does not operate normally when the operating instructions are followed.
 - If the product is damaged from being dropped, in particular if power supply cabinets has been damaged.
 - If the product exhibits a distinct change in performance, indicating a need for service
13. Use only power supply and power cord which is of the same type as the one originally included with the product
 14. Respect local security regulations when using this product. Use appropriate protection for ears and eyes.
 15. Keep away from the equipment during shooting. Observe that security zones often need to be increased when using electronic targets due to increased risk of ricochets. Serious personal injury or death be the result if persons are located between the shooter and the back stop behind the target.

1.1.3 Operational advice

Avoid positioning the device in places exposed to:

- direct sunlight
- high temperatures
- high humidity
- violent vibration
- temperatures below 20 degree Celsius
- voltage surges due to lightning

You may damage the device and/or reduce its operational life.

Always turn off the equipment, disconnect communication cables and unplug the powers supplies when the equipment is not used. The lead battery in the target connection box can be kept on maintenance charging for short periods if appropriate surge protection on the mains is installed.

1.1.4 Warranty

1.1.4.1 Warranty extent

Megalink AS warrants that this product shall be free from defects in material and workmanship for a duration of 1 (one) year, which begins on the date of purchase by the customer. Extended warranty periods can have been granted in the contract. The customer may also have other rights which vary from place to place.

1.1.4.2 Conditions

1. This warranty is not applicable for damage caused by change, adaptation or unauthorized repair of the product.
2. This warranty is not applicable if the serial number and/or type description of the product has been changed, deleted or made unreadable
3. The warranty doesn't cover the following points:
 - Regular maintenance
 - Repair or exchange of parts due to normal wear
 - Other use of the product than the one described in the manual.
 - Cost for transport, travel or living for on-site service and all transport cost and risk which are directly or indirectly related to the warranty.
 - Unsuitable or improper installation or use of software
 - Repair made by personnel not authorized by Megalink AS
 - Accidents, lightning, water, fire, insufficient ventilation or other circumstances which are not in the power of Megalink AS

4. This warranty doesn't restrict the national right of the user, nor the rights of the user due to the contract made with the Megalink AS sales representative.

1.1.4.3 Repair or replacement

If Megalink AS receives, during the applicable warranty, a defect in any product, Megalink AS shall either repair or replace the defective product, at Megalink AS option. Megalink AS shall have no obligation to repair, replace or refund until the customer returns the defective Product to Megalink AS.

Any replacement product may be either new or like-new, provided that it has functionality at least equal to that of the Product being replaced.

1.1.5 Copyright and trademarks

Copyright ©2014 by Megalink AS. All rights reserved.

Megalink and ML2000 are trademarks of Megalink AS.

Other product or company names mentioned herein may be trademarks and/or trade names of their respective owners.

1.2 Introduction

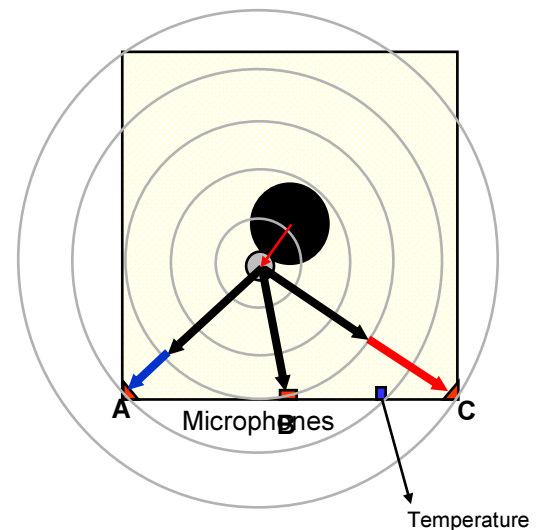
ML2000 is the electronic target system from Megalink. The system consists of a target unit for detection and a display for presentation of the position where the bullet hit the target. The targets can be used as single targets or in larger system solutions. A standard Windows PC with ML2000 software is often used in larger systems in order to extend the possibilities for control, result management and presentation to audience.

The ML2000 system has been designed to be easy to install and operate, but also to give a long lifetime with high operation reliability.

1.3 Description of principles

1.3.1 Sound chamber

ML2000 is based on measuring the sound waves from the bullet when it passes through a sound chamber. The target controller determines differences in time when the front of the sound wave reaches different microphones. Since the position of the microphones is known, and the speed of sound can be calculated by measuring the temperature, the location of the hit can be calculated with trigonometric equations.



The sound chamber has to be designed correct to achieve a reliable and precise detection. This includes the following issues:

- Minimise the temperature fluctuations in the sound chamber
- Reduce noise from bullet catcher, neighbour target or mechanical influence on target
- Precise location of microphones
- Reduce negative impact of weather (wind, rain, sun etc.)
- Precise location of aiming target
- Easy maintenance
- Protection of sensors and cables for shots outside the detection area.

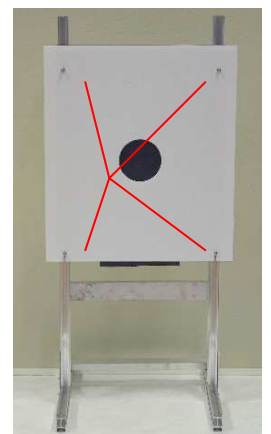
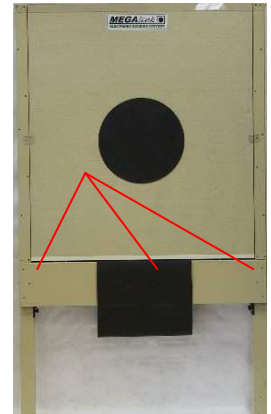
1.3.2 Location of microphones

Better precision can theoretically be achieved by locating four microphones in the corners of the sound chamber, compared to three microphones in the bottom of the chamber. However the corner location suffers from severe drawbacks in large targets for big bore ammunition. These drawbacks are mainly:

- Almost impossible to protect the sensors and cables. Damaged sensors or cables will prevent further use of the target and lead to increased cost of operation.
- Asymmetrical temperature zones will reduce precision
- Difficult to locate the microphone precisely. In addition the large wooden frames will change due to climatic influence and thereby change the location.

With careful design, the location of three microphones in the bottom of the sound chamber will provide the precision needed according to known requirements.

For the smaller short range targets the sensors can be protected and located more



precisely. These targets are therefore configured with four microphones in the corners of the sound chamber, in order to exploit the better mathematical characteristics.

Practical testing has shown that maintenance of the sound chamber is important for all target types. A badly maintained target with four microphones has less precision than a well maintained target with three microphones.

The target units for 10m-50m are equipped with automatic band advance. The models 3U490 and 3U650 for 100m-300m can be delivered with automatic motor advance.

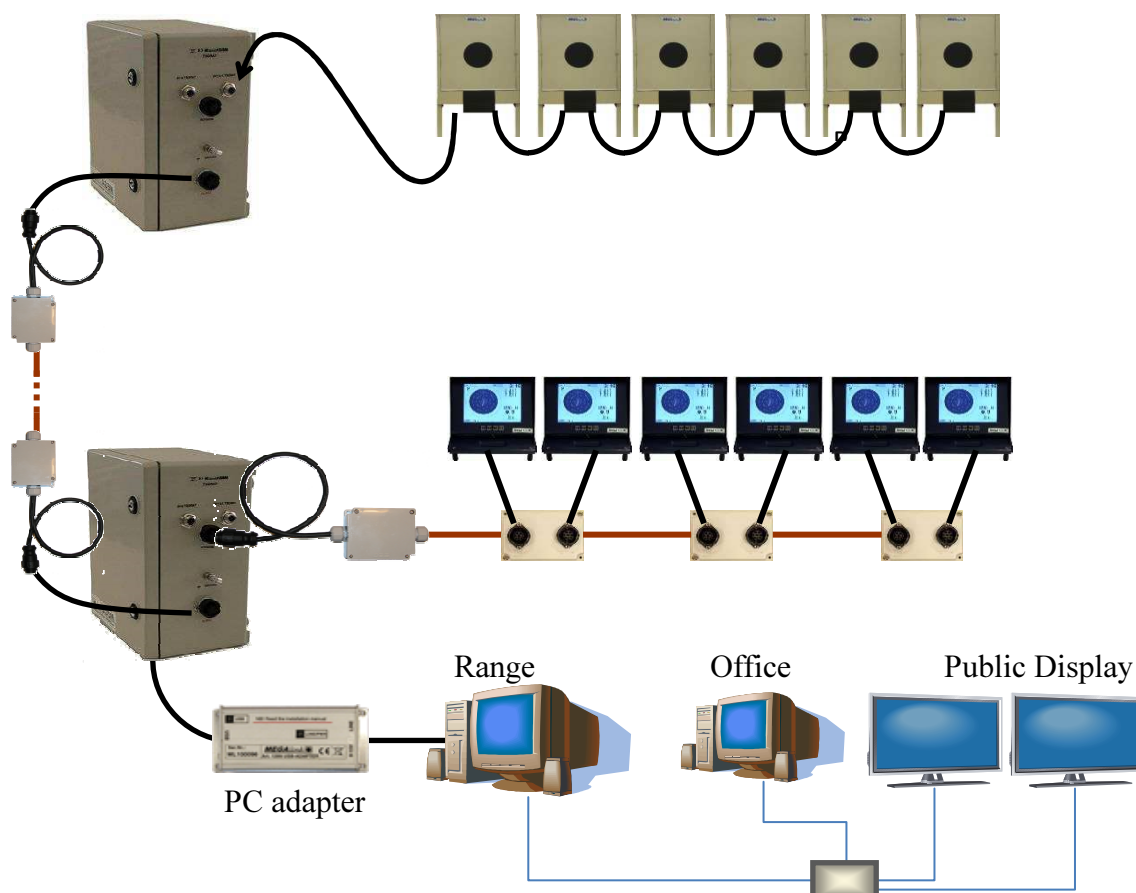
1.3.3 Sound pressure values

Megalink uses a patented technique to detect the level of sound pressure in the triggering sound wave. This has proved to be a unique aid to monitor the detection quality in the targets. The mechanism is used both to evaluate the need for maintenance and to evaluate the status of the target in case of problems or protests regarding the target precision.

1.4 ML2000 system

1.4.1 System overview

The following drawing illustrates how the components can be connected for large ranges:



The components in the ML2000 system can be used in different configuration due to a large degree of flexibility. The example above illustrates a regular configuration for large permanent ranges. Observe the extremely simple cabling between the targets and the shooting stand. In addition the system operates without PC or other central control units.

1.4.2 Display Unit (DU)

The Display Unit (DU = Display Unit) is designed to be well suited for use on a shooting stand. The Display Unit contains all the electronics and software needed to communicate with the targets and to present the bullet hits. The display is operated with four menu buttons on the front. Connection of the Display Unit is done with a single cable located in a cable pocket on the back of the unit. The cable is connected to an outlet located at the shooting stand. This connection provides both data communication and power supply to the unit.

The Display Unit is designed to be placed directly on the shooting stand or to be mounted in a holder. When the unit is folded, the LCD screen is well protected against damages during transport and storage. Due to the easy transportation and connection it is not required to secure the shooting stand against theft, since the equipment can be stored in a safe location elsewhere on the range.



DU2

Display is built around a 9.7" full VGA (640 x 480 pixels) black/white LCD screen. The unit draws a maximum of 0.4 amps.

DU3 – next generation monitor

Display is built around a 10.4" full color LCD screen. Available in two versions: VGA (640 x 480 pixels) and LVDS (800 x 600 pixels). The unit draws a maximum of 0.7 amps. This display is very tolerant of low temperatures.

The power supply for the Display Unit is between 9 and 15 V DC. The system is delivered with a 230V to 12V power adapter for 10 Display Units. The power specification is well adapted to battery operation with standard 12V car battery. This is an advantage for applications with strong requirements for reliability or on ranges with unstable power supply.

1.4.3 Target Controller Unit (CU)

The Target Controller Unit (CU) is located in the target unit. This controller unit performs all necessary measurements and calculations to determine the position of the hits. After shot detection, the shot information is stored in flash memory (permanent electrical erasable memory) before the information is transmitted to the Display Unit at the shooting stand.

The CU is located in the sensor unit under the detection area of the targets for 100m-300m. For short range targets (10m-50m), the CU is located at the back of the target unit. The basic CU is exactly the same on all target models, but the connection system can vary. Even the software is the same on all models, but the Controller Unit has to be configured with lane number and sensor configuration to operate correctly. This configuration is stored in flash memory.

Each CU has two identical outlets. These outlets are used to chain the targets together in a network with use of a single target cable. Up to 10 targets (5 for 25m pistol) can be chained together and connected to a common cabinet with power supply, over voltage protection and communication cable to the shooting stand.

The Controller Unit has two LED indicators that are used to:

- Sensor indicator for monitoring signal on any of the microphones. The microphones and microphone cable can be tested with an easy tap on the top of the microphone.
- Power and Data. Power is indicated with green light, while red flashing can be observed when the unit transmits on the communication line.

The power supply for the Controller Unit is between 9 and 15 V DC, with a maximum power consumption of 0.06A. The power specification is extremely well adapted to battery operation. Standard power supply is a small 12V battery (7Ah) with a 230V battery charger. This solution enables operation without 230V to the target system. Additionally this guarantees reliable operation even with unreliable power supply on the range. We recommend using a standard car battery with larger capacity for ranges with permanent battery operation.

1.4.4 Data communication and cabling

The data communication in a ML2000 system is divided in two separate networks. The Target Controller Units are connected to the Display Units, at the shooting stand, through the Target Network (Gravnett). The second network is used to connect the Display Units to a range management computer. This network is called the Stand Network (Standplassnett).

The communication is low speed, half duplex RS485 through a twisted pair. This method results in a very high level of noise immunity. A single twisted pair is sufficient between the targets and shooting stand for up to 10 targets (5 targets for 25m pistol).

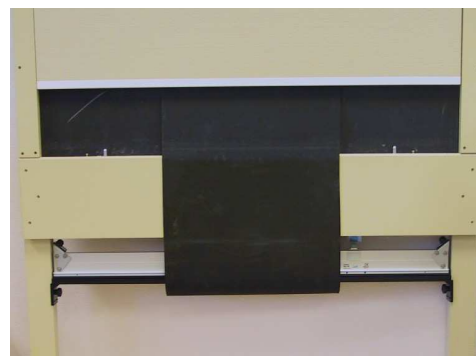
NB! Exactly one Display Unit should be configured as "MASTER" for each target segment (one Target Network). All the other Display Units should be configured as "SLAVE". The master must also be configured to manage the range of targets within the segment (set up FIRST LANE and LAST LANE). Due to this, the master display has to be operational when the system is used.

Some ranges are exposed to damages on the communication circuits due to high voltage generated by lightening. This occurs most frequently on long data cables. Such ranges have to be protected with surge protection in both ends of the communication lines. In addition we have introduced a repeater with galvanic isolation to enhance the protection of the communication circuits in the display and controller units. The repeaters are implemented as a replaceable card in the surge protection components.

1.5 Target unit models

1.5.1 Target model 3U-490/3U-650 (100m-300m)

The targets for 100m-300m have a basic design that can remind of a traditional target unit. The wooden frame is covered with rubber sheets on both sides to create a sound chamber. To get a robust stable construction, the wooden frame is made with laminated pine wood and plywood. Weather protection and temperature stabilisation is achieved with front- and back targets in Styrofoam. The front target is equipped with a black aiming area in 1mm black rubber. All external surfaces are painted in a off white colour, to achieve a comfortable aiming contrast and protection of the wood components.



The front and back targets is constructed in 20mm Styrofoam covered with painted glass fibre wallpaper. The edges are reinforced with plastic profiles. A plastic cover is located on the top of the target to protect against rain, and to hold the front and back targets in place.

The sensor unit is an integrated unit with three microphones, temperature sensor and controller unit. The unit is assembled with a plastic profile and a very stable aluminium profile. The unit is located at the bottom of the sound chamber, and can be lowered for easy access for maintenance.

A movable rubber band is used to maintain the rubber sheet. After a number of shots this rubber band can be moved to remove the worn area. The rubber band is located between the main rubber sheet and the front or back targets.

This target unit can be delivered with automatic motor advance for the rubber band. This automatic advance can also be mounted by the customer after delivery.

1.5.2 Target model 3U-650E (running target)

This target model is basically the same as the 3U-650 unit. The differences are only:

- Lower height (same height as 3U-490).
- The sighting area is extended on plywood at each side of the target.
- The target is delivered without rubber band

The target unit is intended to be located on a existing standard moving target holder. With a target unit, connection cabinet with battery, radio modem and run counters, the system is a complete detection system.

1.5.3 Target model 4K-300/4K-187 (10m-50m)

The target for 10m-50m is constructed as an aluminium frame with microphones in each corner. The aluminium frame is covered with a paper or rubber band in front and a plate of foamed plastic in the back of the chamber. The paper or rubber band is advanced automatically with a motor unit controlled by the controller unit.



1.5.4 Target model 4K-560 (pistol 25m-50m)

The target for 25m and 50m pistol is basically the same as the 4K300 unit. The differences are mainly:

- Larger detection area and external size.
- Protection plate in hard steel to protect against damages from shots.
- Red and green LED lamp for rapid fire. The lamps are controlled by a special controller unit on the target.
- The sighting area is made with a replaceable plastic plate behind the steel plate

1.6 Different usage

The ML2000 system is based on flexible components that can be used in different configurations:

Type of range	Comment
Permanent outdoor range	The system configuration is shown in the overview
Running target	Target unit, power supply cabinet and radio modem is located on the running unit. Display unit, power supply and radio modem is located at the shooting stand.
Indoor short range	Almost identical to a permanent outdoor range. Usually the surge protection is skipped.
Indoor short range with target lift	Individual target lifts with programmable positions. The lifts are controlled from the Display Unit or the Range Management PC.
Pistol range for 25m or 50m	Almost identical to a regular short range configuration. Each target segment will contain 5 targets. The light signals for rapid fire is controlled from the Display Unit or the Range Management PC.
Stand alone target with PC	System with target unit, PC-adapter, power supply, cable and PC

	with MLShoot software. A simple solution for personal usage.
Stand alone target with display unit	A single target unit, monitor and simplified cabling and power supply. This results in a flexible, mobile practice solution for different shooting ranges.

1.7 PC software

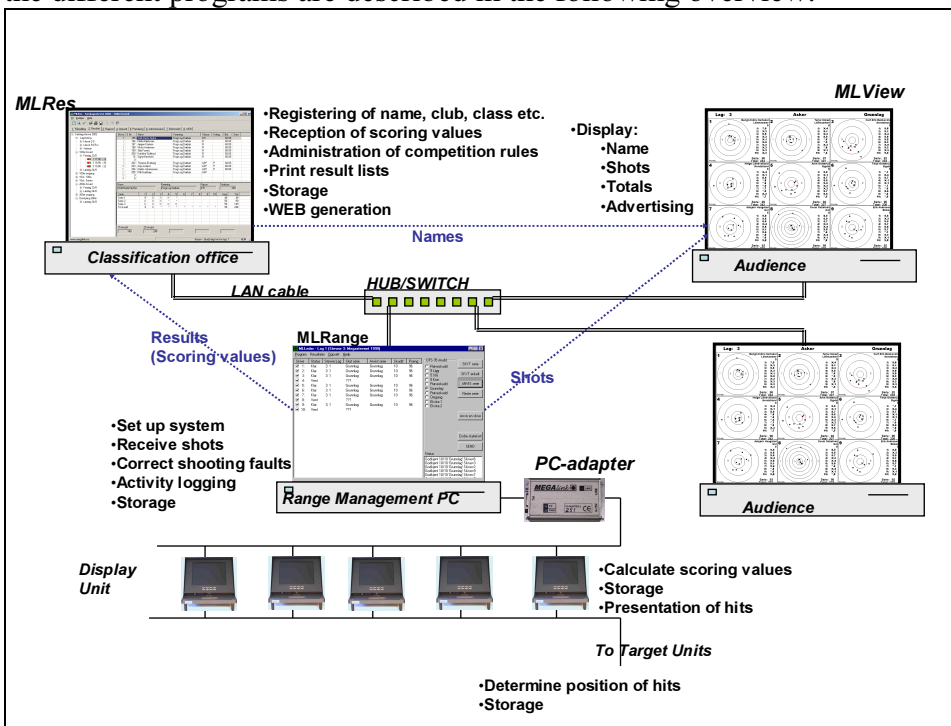
1.7.1 Overview

The basic components, in the ML2000 system, handle detection and presentation of the shots without any need for PC connection. For use in competition there are additional requirements:

- Range management
- Office functions for registering names and handling result lists etc.
- Audience services

A set of software for standard Windows PC has been developed to meet these requirements. With this software, the shots from the electronic targets are automatically displayed on audience screens and transferred to the classification office. The shots are received into the PC systems through a Range Management Program (MLRange) close to the shooting stands. The connection is done with a PC-adaptor on the serial port of the PC. A standard Local Area Network (LAN) is used to connect the other PCs to the range management computer.

Installation and usage of the PC software is described in a separate chapter. The main functions of the different programs are described in the following overview:



1.7.2 Range Management – MLRange

MLRange is installed and runs on a PC close to the Display Units at the shooting range. The program is handled by the range officer (or an assistant), and is used for the following tasks:

1. Prepare and set up the system for competition
2. Receive shots from the ML2000 electronics
3. Monitor the progress of the shooting
4. Call the next relay to the shooting stand

5. Correct results in case of faults
6. Detailed logging and storage
7. Controlling special final marking

1.7.3 Audience Display – MLView

MLView is started on PCs that are visible for audience, speaker or others that wants to follow the shooting. The program is typically installed only on the PC in the classification office. In this way the management of the different MLView PCs are centralised. The MLView program is used to:

1. Display shots immediately when they are detected.
2. Display score for series, subtotal and grand total.
3. Display placement and differences in finals.
4. Display name, club, class and category
5. Graphical or text based display
6. Advertising (commercial or service information)
7. Display intermediate or final result lists
8. Configure and set up the system to display the wanted information

1.7.4 Result Management – MLRes

MLRes is used in the registration and classification office. The program is fully network based and supports a wide range of shooting competition and result management requirements. Some features are:

- Standard competitions with integer or decimal scoring with ten or eleven scoring rings (i.e. all ISSF rifle and pistol events plus a wide range of similar shooting)
- Hit/miss targets. Competitions with timed result etc.
- Self updating shooter database with name, club and class
- A wide range of standard shooting programs in addition to virtually unlimited definition of special shooting programs.
- All types of teams. Either pre registered or rules based.
- Support for exchange with different electronic scoring targets (Megalink, Sius-Ascor, Kongsberg Mikroelektronikk)
- Automatic generation of WEB pages for audience, speaker or WEB site.
- Exchange with WEB based registration of shooters

1.7.5 Network operations – MLRemote

MLRemote is used get access to administrative functions from any PC through the network. The most important function is to generate graphical prints of the shots. Use on-line help to see which other functions are available.

1.7.6 System Administration – MLAdmin

MLAdmin is used for maintenance of the software in the electronic target system (Display Unit and Target Controller Unit). The program runs on the Range Management Computer and is used for the following tasks:

- Display SW versions currently installed
- Display the shot and error counters in the targets
- Upgrade SW in Display Units or Target Controller Unit.
- Optional configuration of the Target Controller Unit (usually done with a Display Unit)

1.7.7 Smartcard Administration - MLCard

MLCard is used for administration of the user cards when the smart card system is used. The program can run on any PC as long as a card reader is installed and the Administration Card for the range is available.