MRW

Motorized Rotary Wheels

Fig. 1 Most popular models of MRW rotary wheels(from the left MRW-75-12, MRW-75-8, MRW-44-12 and MRW-44-8)

1 Basic information

It is technically possible to test EO imaging/laser systems using simple mechanical adapters that enable manual replacement of the active target located at the collimator's focal plane. However manual target exchange is inconvenient, time-consuming, and – most importantly – can lead to unwanted temperature fluctuations of the target. Therefore Motorized Rotary Wheels (MRW) are essential components of Inframet systems for testing electro-optical imaging devices. Their main function is to enable automated switching of test targets placed at the focal plane of a collimator. There are six available MRW models.

2 Models of MWR wheel

Tab. 1: Available models of MRW rotary wheels

Model	Max target size [mm]	Number of targets	Optimal size of source emitter [mm]
MRW-44-8	44	8	50
MRW-44-12	44	12	50
MRW-75-8	75	8	100
MRW-75-12	75	12	100
MRW-107-8	107	8	150
MRW-107-12	107	12	150

The primary difference between MRW models is in the maximum size of the target they support. There are three standard target sizes: 44 mm, 75 mm, and 107 mm. This size refers both to the side length of square slots and the diameter of circular slots in the wheel.

Each MRW wheel includes either 8 or 12 slots for mounting target plates. The first slot is square, while the remaining ones are circular. Custom configurations (e.g., all slots circular or other combinations) are available upon request.

Rotary wheel must be compatible with other blocks of the test system: 1) emitter of the radiation source must be bigger than slot of the rotary wheel, 2) collimator FOV must be bigger than slot of the rotary wheel.

Therefore, using rotary wheels designed for 75 mm or 107 mm targets is only meaningful when paired with appropriate radiation sources (with larger aperture sizes) and collimators equipped with larger secondary mirrors.

3 Compatibility to other blocks of test system

The table below lists all MRW models along with the recommended radiation sources (optimal emitter size) and recommended collimators (best field of view and secondary mirror size).

Tab. 2: Compatibility of MRW rotary wheels, radiation source and collimators

Model	Compatible radiation sources	Compatible collimators
MRW-44-8	TCB-2D, DCB-2D, MTB-2D, LS-DAL-50, LS-SAL50	All collimators with aperture smaller than 200mm and CDT20160
MRW-44-12		CDT25200, CDT30200, CDT30300, CDT35200, CDT40240
MRW-75-8	TCB-4D, DCB-4D, LS-DAL-100, LS-SAL100	CDT20200, CDT25200, CDT30300,CDT35200, CDT35350, CDT40240
MRW-75-12		CDT40400, CDT50300, CDT50500
MRW-107-8	TCB-6D, DCB-6D, LS-DAL-150, LS-SAL150	CDT45500, CDT50500
MRW-107-12		CDT60600

4 Mechanical drawings

The diagram below illustrates the interior of the MRW-44-8 and MRW-44-12 models, showing how the targets are mounted. Each standard wheel contains one rectangular slot for the largest target and circular slots for the remaining positions. Cross-sectional views provide detailed mechanical dimensions necessary for designing compatible target frames. Alternate slot configurations are available upon request.

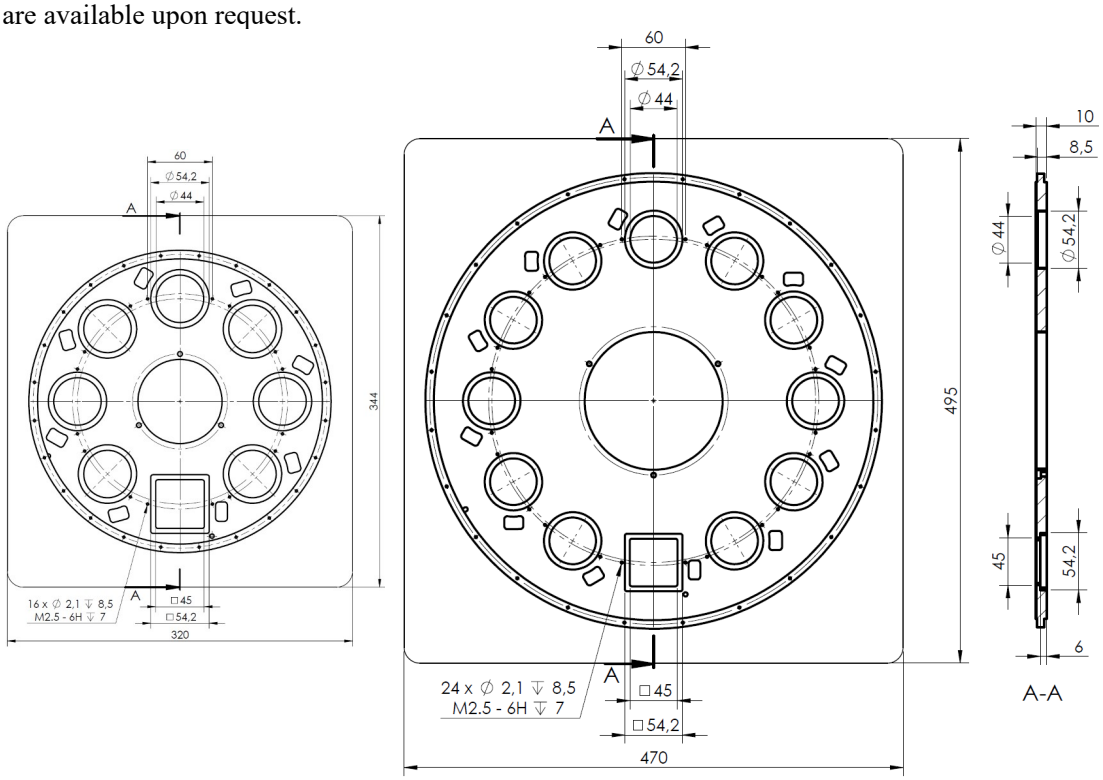

Fig. 2 Exemplary drawing of MRW-44-8 and MRW-44-12 interior.

5 Control of MRW wheels

MRW wheels can be controlled in two ways: via PC (using the dedicated MRW Control software) or via an external electronic controller CMRW.

Fig. 3 Two options of MRW control: from PC (on the left) and from CMRW Controller (on the right)

PC-based control is the standard solution and is recommended in automated test environments where a computer is already used to conduct measurements. This method also enables full automation of the measurement process using custom software, as an optional API for MRW is available.

The CMRW external controller is intended for users who operate manual test systems without a PC. It provides a display showing the current target position and allows the user to change the active slot by selecting the desired number.

6 Exchange of radiation sources

In systems equipped with multiple radiation sources (TCB/MTB blackbodies, LS-DAL light source), manual source replacement is usually required. However, this can be difficult for large radiation sources mounted on sizable collimators. To overcome this, Inframet offers optional integration of MRW wheels (all MRW except MRW-44-8) with the YEX motorized platform for automated radiation source exchange.

To summarize, there are two ways to change radiation source that irradiates active target of MRW wheel: 1)manual human operator, 2)YEX platform integrated with MRW wheel. The YEX platform allows switching between two different radiation sources using either a PC application or an external controller.

Fig. 4 MRW-75-12 integrated with YEX platform. DCB-4D blackbody and LS-SAL light source are mounted on the platform (LS-SAL in active position)

7 API

API option means Inframet delivers MRW driver API description, along with sample tutorials and documentation. The API allows End-user to control the target wheel position. MRW driver is developed for .NET Framework platform, and can be used under multiple other programming languages (e.g. C++, Python with IronPython) and tools (like LabView, using Connectivity – .NET palette). It also can be used under many Linux distributions (Mono.NET is required).

8 Focusing MRW wheels

Focusing MRW wheels

Focusing rotary wheel is an operation of precise linear movement of target along optical axis of collimator. In other words it is precision regulation of distance between targets inside wheel and collimator focal plane. Variation of this distance enables to vary distance to target that is perceived by tested imager – that see images of these targets projected by collimator. If the distance from target to focal plane equals zero then collimator simulates targets located at infinity distance.

Inframet offers special version of MRW coded as FRW focusing rotary wheel that is a special rotary wheel that combines rotation with precision linear movement along collimator optical axis (movement range at least 20mm).

Fig. 5 Exemplary FRW focusing rotary wheels (setup with TCB-2D): from the left FRW-75-8 and FRW-44-8

9 Versions

MRW wheels can be delivered in a series of versions of different performance and price. In order to define version used is expected 1) to choose one of MRW models listed in table 1; 2) to choose optional features (code) from the table below

Tab. 3: Coding of MRW optional features

MRW model *select one from the list*	-	**Positioning accuracy**		-	**External controller**		-	**Source exchanger**		-	**API**		-	**Focusing**	
		Optional code *Leave the fields empty or put the letter code*													
MRW-44-8		Standard (<0.08mrad)	Empty field		No external controller. PC control.	Empty field		Manual by operator	Empty field		No	Empty field		No	Empty field
MRW-44-12															
MRW-75-8															
MRW-75-12		Ultra-high positioning accuracy (<0.03 mrad)	**U**		External controller (CMRW) for PC-free operation;	**C**		Integration with the YEX platform for automatic source exchange;	**Y**		API for the MRW driver	**A**		Special version of MRW wheel capable to precise focusing of targets in the wheel	**F**
MRW-107-8															
MRW-107-12															

Example codes:

- MRW-107-8 means MRW 107-8 model in basic version (no U,C,Y,A,F options)
- MRW-107-8-UCY means MRW 107-8 model in with options U,C,Y.

If F option is needed then it is also accepted if model code is changed to from MRW to FRW. This special treatment of focusing is due to big change of design needed when this option is chosen.

10 Technical specifications

Model/features	**MRW-44-8**	**MRW-44-12**	**MRW-75-8**	**MRW-75-12**	**MRW-107-8**	**MRW-107-12**
Size of target slot	44 mm	44 mm	75 mm	75 mm	107 mm	107 mm
Number of target slots	8 slots: 1 square & 7 circles	12 slots: 1 square & 11 circles	8 slots: 1 square & 7 circles	12 slots: 1 square & 11 circles	8 slots: 1 square & 7 circles	12 slots: 1 square & 11 circles
Wheel emissivity	0.98±0.02					
Dimensions [mm]	344×320×107	495×470×107	495×470×107	660×635×107	660×635×107	910×950×107
Mass	6 kg	15 kg	15 kg	28 kg	28 kg	58 kg
Positioning accuracy	Standard version: <0.08mrad Option U: <0.03mrad					
Control of MRW wheel	Standard version: PC via USB cable and Target Control program *Option C: CMRW controller*					
Exchange of radiation sourc	Standard version: Manual by human operator Option Y – YEX platform for automatic source exchange;					
Radiation sources exchange	Manual	Standard version: Manul *Option Y: YEX motorized platform*				
API	Standard version: No Option A: Yes					
Focusing	Standard version: No (simulated distance : only infinity) Option F- special version of MRW wheel capable to precise focusing of targets in the wheel (regulated simulated distance)					
Focusing range	20mm (option: 40mm)					

11 Summary

Inframet offers a series of versions of MRW rotary wheels of different performance. These rotary wheels can fulfill requirements even of most demanding applications.