

The background is a blue-tinted photograph of an industrial setting. On the left, a robotic arm is visible. On the right, a person's hands are holding a tablet computer, which displays various charts and graphs. The overall scene suggests a focus on automation and data analysis in manufacturing.

EAWS

to guarantee good productivity

Manuela Ostermeier, MTM ASSOCIATION e.V.

Ergonómiai Nyári Egyetem - 2026 Budapest

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Introduction



Manuela Ostermeier



MTM ASSOCIATION e. V.,

Team Leader of digitalization & internationalization
for MTM-Trainings

Head of MTM Partnerships

Project Leader EAWS 2.0

Leader EAWS User Group Germany

MTM & BMW Instructor



At a glance

- | | | |
|-----------------|------------------|---------------------------------------|
| ▪ Bachelor | TH Wildau | Industrial Engineering |
| ▪ Master | TH Wildau | Technical Management and Logistics |
| ▪ MTM-Institute | Zeuthen (Berlin) | Research Work, Teaching, Project Work |

Agenda

EAWS – Brief Overview

EAWS in TiCon – Software Solution

EAWS 2.0 – Research Project

EAWS

(Ergonomic Assessment WorkSheet)

Quote of Voltaire about health

"In the first half of our lives we sacrifice our health, to earn money, in the second half of our lives we sacrifice our money, to recover the health."

Voltaire
(1694 – 1778)



Definition of Ergonomics

Definition

Ergonomics

The term “Ergonomics” derives from the Greek words "**érgon**" (work) and "**ńomos**" (norm, standard, law).

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.

EAWS compatibility to International Standards and other systems



	Standards		Tools		
Risk Areas	CEN	ISO	Correlated single systems	Combined systems	
Body Postures with low external effort	1005 - 4	11226	OWAS	AAWS	EAWS
Action Forces	1005 - 3	11228-2	RULA		
Manual Material Handling (Repositioning)	1005 - 2	11228-1	NIOSH		
Upper Limbs - high frequencies/low loads	1005 - 5	11228-3	OCRA, Strain Index, HAL-TV		

EAWS - Ergonomic Assessment WorkSheet

Page 1 (Section 0)

Ergonomic Assessment Worksheet v1.3.6

Name: _____ Supervisor: _____

Line: _____ Task description: _____

Result of overall evaluation: _____

Extra points (Whole body) (per minute / shift): _____

Extra points (Upper limb) (per minute / shift): _____

Header Overall evaluation Extra points

Page 2 (Section 1)

Ergonomic Assessment Worksheet v1.3.6

Basic Postures / Postures and movements of trunk and arms

Postures: _____

Sum of time: _____

Postures = 2 times 1-15

Page 3 (Section 2 and 3)

Ergonomic Assessment Worksheet v1.3.6

Action forces (per minute)

Forces: _____

Manual Material Handling (per shift)

Frequency of load handling (per shift)

Manual Material Handling (per shift)

Page 4 (Section 4)

Ergonomic Assessment Worksheet v1.3.6

Upper limb load in repetitive tasks

Upper Limbs: _____

Upper limb load in repetitive tasks

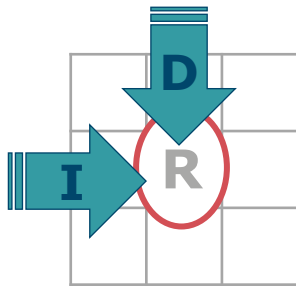
Header
Overall evaluation
Extra points

Postures and
movements

Action forces
Manual Material
Handling

Upper
Limbs

Introduction to EAWS scoring system



EAWS determines a load index (**R**), multiplying the intensity score **I** by the duration score **D**

$$R = I \times D$$

In Section 1 (Body Postures) and Section 4 (Upper limbs) the load index (**R**) is given directly in the EAWS form

		Forces onto fingers of <30 N										Evaluation of static postures and/or high frequency movement trunk postures									
		[%]										Duration [s/min] = $\frac{\text{Posture [s]}}{\text{min [s]}}$									
		5	7,5	10	15	20	27	33	50	67	83	3	4,5	6	9	12	15	20	30	40	50
		[s/min]										[min/8h]									
		24	36	48	72	96	130	160	240	320	400	24	36	48	72	96	130	160	240	320	400
1	Standing & walking in alternation, standing with support																				
2	Standing, no body support (for other restrictions see Extra Points)																				
3	a Bent forward (20-60°)																				
	b with suitable support																				
4	a Strongly bent forward (>60°)																				
	b with suitable support																				
5	Upright with elbow at / above shoulder level																				
6	Upright with hands above head level																				

Upper limb load in repetitive tasks																								Upper Limbs					
Force & Frequency & Grip (FFG)																								Basis: number of real actions per minute or percent static actions (analyze only the loaded limb)					
	a	%SA = Percentage of Static Actions										%DA = 100% - %SA																	
power grip/contact grip		FDS = Force-Duration Static										FFD = Force-Frequency Dynamic																	
	b	GS' = Modified Grip Points Static (Grip x %SA)										GD = Grip Points Dynamic																	
finger or moderate pinch (thumb to >2 fingers, finger)		%FLS = Percentage of Static Actions at force level										%FLD = Percentage of Dynamic Actions at force level																	
	c	SC = Static Contribution										DC = Dynamic Contribution																	
strong pinch (thumb to 1 or 2 fingers)		FDGS = Sum of Static Contributions										FFGD = Sum of Dynamic Contributions																	
Force [N]		Calc Stat					Static actions (s/min)							Grip		Dynamic actions (real actions/min)										Calc Dyn			
		FDS	GS'	%FLS	SC	≥45	30	20	10	5	3	0	2	4	25	10	15	20	25	30	35	≥40	FFD	GD	%FLD	DC			
0 – 5						1	1	0	0	0	0	abc			0	0	0	1	2	3	4	7							
> 5 – 20						4	2	1	1	0	0	ab	bc		0	0	1	2	3	4	6	9							
> 20 – 35						7	5	3	2	1	1	ab	b	c	0	1	2	3	4	6	8	12							
> 35 – 90						11	8	5	3	2	1	a	b	b	1	2	3	5	7	9	12	18							

Overall Evaluation

The EAWS sheet provides one score for each Macro-Section which is shown in a traffic light scheme (green, yellow, red) according to the Machinery Directive 2006/42/EC (EN 614).

0 - 25 Points	Green	Low risk	Recommended; no action is needed
> 25 - 50 Points	Yellow	Possible risk	Not recommended; redesign if possible, otherwise take other measures to control the risk
> 50 Points	Red	High risk	To be avoided; action to lower the risk is necessary

Awkward postures of Upper Limb - Example

Cycle time: 5 s; 2 times per cycle cut the wire with 20 N

Used Aid:



Result

Upper limbs



Task	2.8 Points
+ Hand/Arm/Shoulder	3.8 Points
+ Further factors	0.0 Points
* Duration	10.0 Points
Total points	66.0 Points

Used Aid:



Result

Upper limbs



Task	2.8 Points
+ Hand/Arm/Shoulder	0.0 Points
+ Further factors	0.0 Points
* Duration	10.0 Points
Total points	28.0 Points

TiCon – Software Solution

Workplace Organization



Ergonomic Assessment Worksheet v1.3.6

Plant

Gender of operator ☐ m ☐ f ☐ dy height

Line

MTM Analysis

Analyst

Task / Workplace

Task duration [s]

Observation ☐

Planning ☐

Result of overall evaluation:

Calculate the total score of whole body and compare it for the risk score. The overall result is determined by the higher value and the appropriate traffic light is checked. Anyway, interpretation should take into account both

☐ Green
☐ Yellow
☐ Red

Whole Body =

Postures +

Forces +

Loads +

Extra +

Upper Limbs

EAWS evaluation

0-25 Points
25-50 Points
>50 Points

Green
Yellow
Red

Low risk: recommended; no action is needed
Possible risk: not recommended; redesign if possible, otherwise take other measures to control the risk
High risk: to be avoided; action to lower the risk is necessary

Extra points "Whole body" (per minute / shift)

Extra points

0a
Adverse effects by working on moving objects

0 3 8 15
none middle strong very strong

Intensity

0b
Accessibility (e.g. entering motor or passenger compartment)

0 2 5 10
good complicated poor very poor

Status

0c
Countershocks, impulses, vibrations

0 1 2 5
light visible heavy very heavy

Intensity × frequency

0d
Joint position (especially wrist)

0 1 3 5
neutral ~ 1/3 max ~ 2/3 max maximal

Intensity × duration or frequency

0e
Other physical work load (please describe in detail)

0 5 10 15
none middle strong very strong

Intensity

Extra = Σ lines 0a – 0e

note: Max. score = 40 (line 0c, 0d); Max. score = 15 (line 0a, 0e); Max. score = 10 (line 0b)

note: correct evaluation, if duration of evaluation = 60 s

Lines 0a-b mainly relate to the Automotive industry, for other sectors additional elements may be necessary. For details see the EAWS manual.

Shift Duration and Tasks:

Comments / proposals for improvements

Description

Formula

Result

Real shift duration [min]

Lunch break [min]

Other official pauses [min]

Non repetitive tasks (i.e. cleaning, supplies, etc.) [min]

Net duration of repetitive tasks (a) [min]

No. of real units (or cycles) (b)

Net cycle time [s]

Idle Time [s]

EAWS Analysis [ED]

Header

Criteria

Workplace organization

EAWS Structure

Extra points

OIM

Evaluation

Documents

Usage

Text

Picture

Journal

Input mode:

Shift duration (gross) / cycle time

Shift duration (gross):

8.5

Hours [h]

Breaks:

- 0.5

Hours [h]

Lunch break

Work organization:

Work interruptions are possible at every time (Process is not interrupted)

Not repetitive times:

- 0.0

Hours [h]

Shift duration (net):

= 8.0

Hours [h]

Number of cycles:

÷ 480

Cycle time:

= 60

Seconds [s]

Allowance:

0

%

Performance level:

100

%

Workplace:

Free walking on workplace possible

Height percentile:

50. height percentile

Force percentile:

neutral [MTM.40.N]

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Body Postures

EAWS Analysis [ED]						
Header Criteria Workplace organization EAWS Structure Extra points OIM						
No.	Description	Durati...	Number	Freque...	Total time	Body posture
1	Body posture - Standing and walking		1	1		
2			1	1		
3			1	1		
4			1	1		
5			1	1		
6			1	1		
7			1	1		
8			1	1		

9	Body posture - sitting		1	1		
10			1	1		
11			1	1		
12			1	1		
13			1	1		
14	Body posture - kneeling or crouching		1	1		
15			1	1		
16			1	1		
17	Body posture - lying or climbing		1	1		
18			1	1		

Asymmetric postures

Trunk angle of asymmetry	Trunk incline	Trunk incline	Whole body f	Far arms	Finger for
slightly $\leq 10^\circ$	slightly $\leq 10^\circ$			close to body	
medium $\sim 15^\circ$	medium $\sim 15^\circ$			60% reach	
strongly $\sim 25^\circ$	strongly $\sim 25^\circ$			80% reach	
extreme $\geq 30^\circ$	extreme $\geq 30^\circ$			Arm stretched	

Asymmetric					
Trunk Rotation		Lateral Bending 1)		Far Reach 2)	
int	dur	int	dur	int	dur
0-5	0-3	0-5	0-3	0-5	0-2
Intensity x Duration		Intensity x Duration		Intensity x Duration	

1)						2)					
Trunk		0	1	3	5	Far Reach		0	1	3	5
int	dur	slightly $\leq 10^\circ$	medium 15°	strongly 25°	extreme $\geq 30^\circ$	int	dur	close	60%	80%	arm stretched
0	never	1,5	2,5	3		0	never	1	1,5	2	
	0%	6%	15%	$\geq 20\%$			0%	6%	15%	$\geq 20\%$	

Upper limbs

Manual material handling

Awkward posture of shoulder (extension / abduction):

Duration: 0.0 Percent

Awkward posture of shoulder (Flexion):

Duration: 0.0 Percent

Awkward arm posture:

Duration: 0.0 Percent

Awkward hand posture:

Duration: 0.0 Percent

OK

Hand / arm / shoulder postures (use duration for worst case of wrist / elbow / shoulder)											
Wrist (deviation, flex./extens.)				Elbow (pron./sup. flex./extens.)				Shoulder (flexion, extension, abduction)			
20b											
Posture points											
10%				25%				33%			
0				0,5				1			
								2			
								3			
								4			
								PP			

Forces



Finger forces	Arm force	Upper limbs	
...	Amount		
1 x			

Amount of force:
Amount of force:

Duration of strain
☐ static ☒ automatic ☐ dynamic
 Duration: 100 % Number: 1 x

☐ Count as cycle
☐ Can be merged with preceding force.

OK

Finger forces

Arm force	Upper limbs	Manual mate
...	Amou... +A v	
1 x		

Amount of force:
Amount of force:

Direction of force

 +A -A +B -B +C -C

Duration of strain
☐ static ☒ automatic ☐ dynamic
 Duration: 100 % Number: 1 x

☐ Count as cycle
☐ Can be merged with preceding force.

OK

Arm/Whole body forces

Manual material handling

Manual material handling

☐ Merge with preceding load to one manual material handling

...

No handling of loads

Repositioning

Holding

Carrying

Pulling & pushing (short)

Pulling & pushing (long)

Automatically detect type of load

mbs

Manual material handling

Amount: 1 x

Load at body (< 10 cm)

Stable

One operator

Type of load: Repositioning

Amount: 1 x

Number: 1 x

Posture: ☒ Calculate posture points automatically

Load at body (< 10 cm)

☐ Instable

☐ Set posture points manually

1 posture point

☐ Two operators

Action: Determine action automatically (recommended)

☐ Count as cycle

☐ Merge with preceding load to one manual material handling

OK

Result (Overview)

Extra points

OIM

Evaluation

Documents

Usage

Text

Picture

Journal

The work content of one operator lasting 120.0 s has been analyzed. EAWS method in version E 1.3.6 2024-02-02 with the force percentile MTM.40.F was used for analyzing.

Evaluation

Whole body



Posture	58.5 Points
+ Forces	25.0 Points
+ Manual material handling	0.0 Points
+ Extra points	0.0 Points
Total points	83.5 Points

Upper limbs



Task	4.1 Points
+ Hand/Arm/Shoulder	0.0 Points
+ Further factors	0.0 Points
* Duration	8.0 Points
Total points	33.0 Points

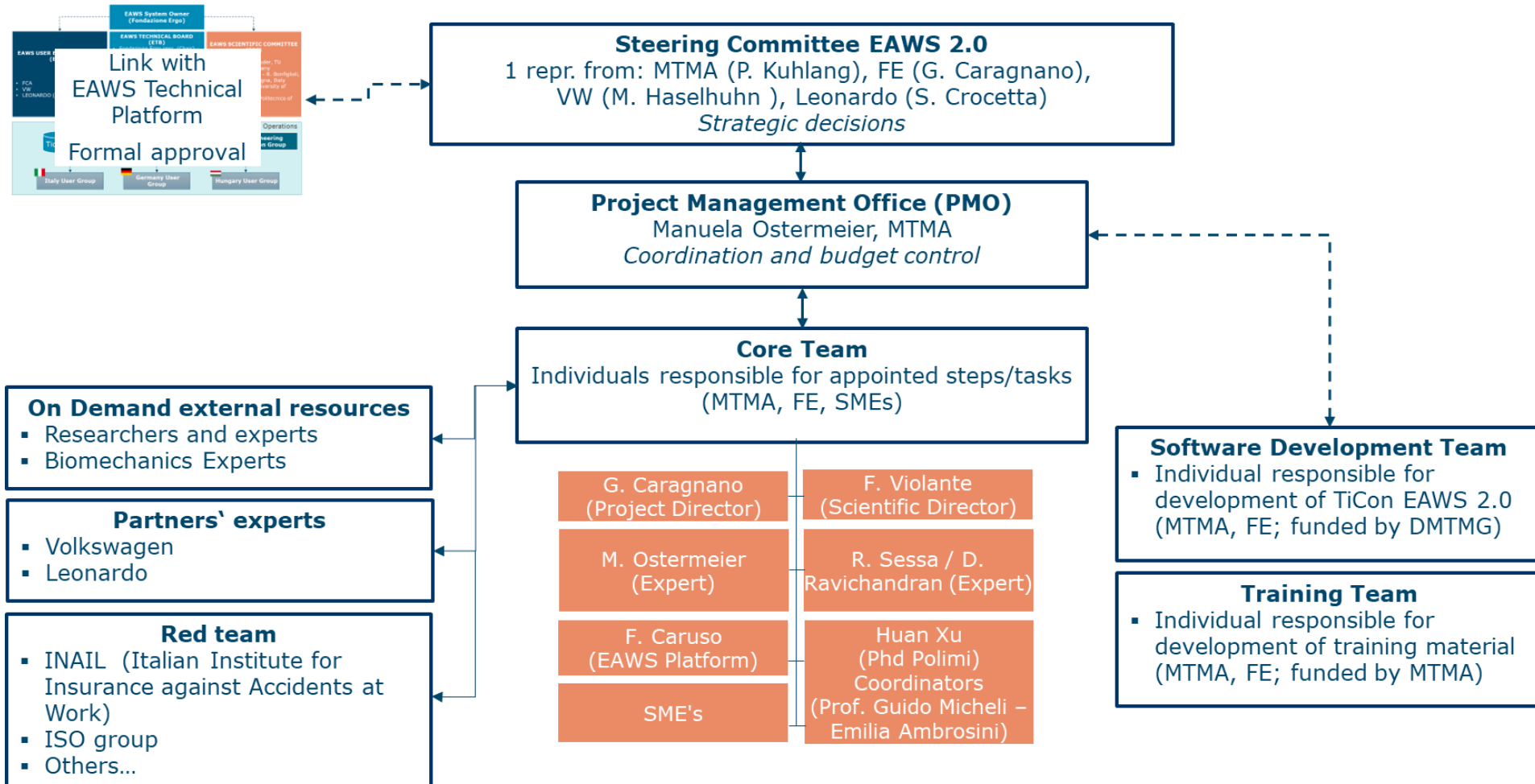
☐ Green	Whole Body	=	Postures	+	Forces	+	Loads	+	Extra	Upper Limbs
☐ Yellow		=		+		+		+		
☐ Red										

EAWS evaluation	0-25 Points	Green	Low risk: recommended; no action is needed
	>25-50 Points	Yellow	Possible risk: not recommended; redesign if possible, otherwise take other measures to control the risk
	>50 Points	Red	High risk: to be avoided; action to lower the risk is necessary



EAWS 2.0

EAWS 2.0 – Project Organization



Objective

Improve EAWS structure to better adapt digital application in the planning phase to reach high productivity with lower ergonomic risks.

- Transform the EAWS structure to improve its capability to drive method design and to reduce ergonomic risk from the earliest product/process design stages
- Sharpen definitions and application rules to ease the digitization process of ergonomic assessment
- Integrate relevant influencing factors to make EAWS the global world class ergonomic standard for any cyclical industrial type of manual work
- Strengthen the link with MTM systems to guarantee a fair trade-off between productivity and workers well-being

What will be the differences?

Current EAWS

- Sections

- Extra Points
 - Body Postures
 - Forces
 - Loads
 - Upper Limb
-
- Risk assessment per section and a result for the whole body and the upper limb
→ we know where the strain comes from, but not where its effect is released

Whole Body	=	Postures	+	Forces	+	Loads	+	Extra	Upper Limbs
	=		+		+		+		

Prospective EAWS

- Body Segments

- Neck
 - Upper Limb
 - Lower Limb
 - Trunk
-
- Generate a risk assessment per segment and a cumulative evaluation of the risk for the whole body → More transparency where the potential risk affects the employee



Status:

EAWS Screening Tool (Field Test)

- VW Group (work group – partner of the project)
- Leonardo (partner of the project)
- EAWS User Group Germany
- Interested companies

Questions / Hints?



Manuela Ostermeier

Head of MTM Partnerships
Team Leader Digitization & Internationalization of MTM-Trainings
MTM Instructor

+49 151 17111 807

manuela.ostermeier@mtm.org

MTM ASSOCIATION e. V.
Eichenallee 11
15738 Zeuthen
Germany
mtm.org