



Whitepaper

Glasgow ECG Analysis Algorithm

Version 1.1

Disclaimer

This white paper explains the basic function of ECG analysis with the Glasgow algorithm.

It is based on the user's introduction to the device and knowledge of the user manual.

The use of an automated ECG analysis does not replace the ECG interpretation skills of the user.

Upgrade to the Glasgow ECG Analysis Algorithm

From version 4.1 of the **corpuls3** software, the ECG analysis is changed from HES® to the Glasgow algorithm.

The database was created in 1964 at the University of Glasgow and has been continuously developed since then. This ECG database contains a large number of ECG data from all age groups. This allows an improved ECG interpretation adapted to the age of the patient.



Glasgow versions

The analysis by the Glasgow algorithm is available on the **corpuls3** in two different versions:

Glasgow Basic	Glasgow Full Scale
Measurement table with <ul style="list-style-type: none"> • P duration • PR interval • QRS duration/time • QT interval • ST segment measurement in standard Einthoven, Goldberger and Wilson leads 	Alarms with short ECG interpretation Additionally: <ul style="list-style-type: none"> • Advanced measurement table for all leads • Supplementary parameters

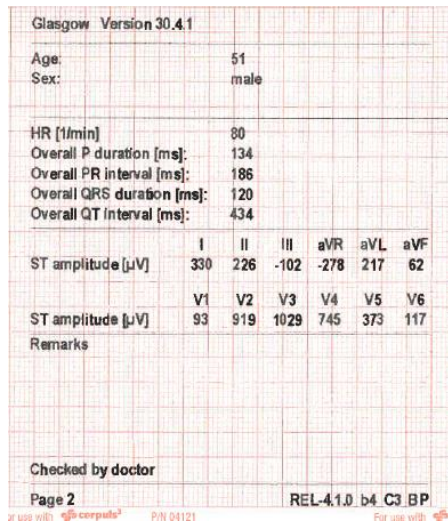


Fig. 1: ECG printout using Glasgow Basic

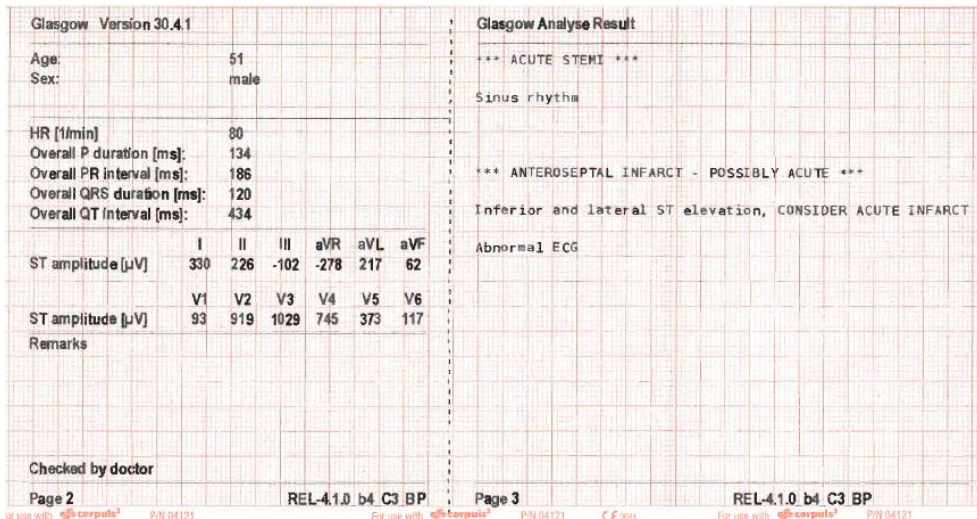


Fig. 2: ECG printout using Glasgow Full Scale (ECG interpretation)

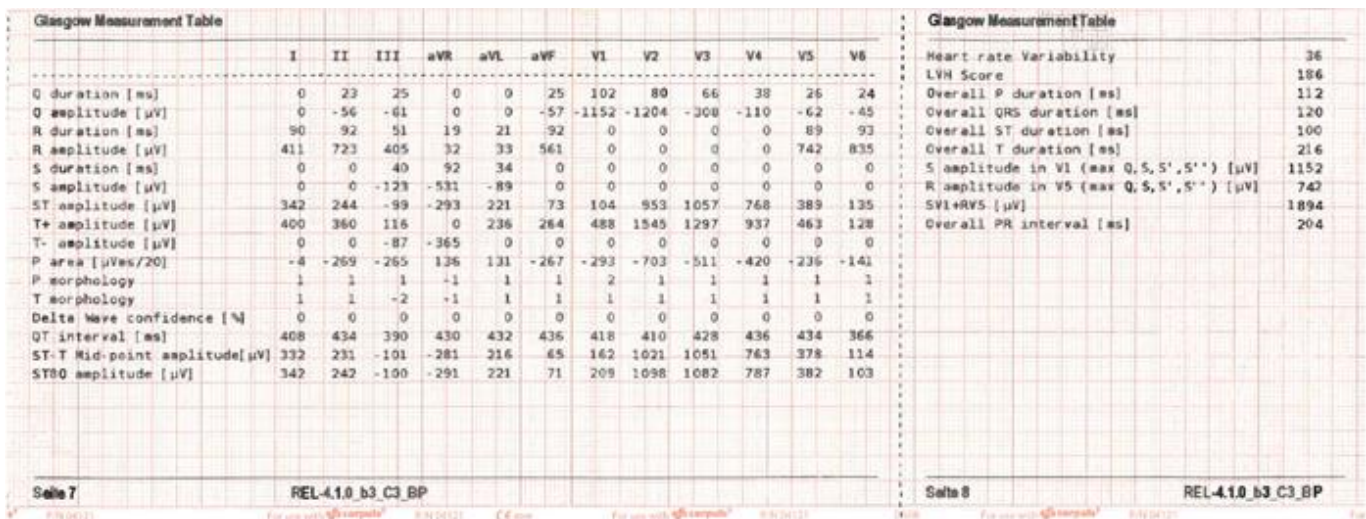


Fig. 3: ECG printout using Glasgow Full Scale (measurement table)



Software version and effects

The following overview shows the available software versions of the **corpuls3** and the options of the ECG analysis:

	Software before 4.1.1	Software 4.1.1	Software 4.1.2	Software 4.2.x	
Standard-configuration	HES light	Glasgow Basic	HES light	Glasgow Basic	
Optional	HES pro mit corpuls S / ACS	Glasgow Full Scale	HES pro mit corpuls S / ACS	HES pro mit corpuls S / ACS	Glasgow Full Scale

The licences for ECG analysis are available under the following article numbers:

- 04208 HES pro
- 04209 Glasgow Full Scale
- S04209 Upgrade Glasgow Full Scale
- S04209.2 Upgrade from HES pro to GlasgowFull Scale

Interaction of corpuls3 and the Glasgow algorithm

The Glasgow algorithm is an application installed on the **corpuls3** which is used for interpretation of D-ECG data.

The ECG is recorded by the **corpuls3**, the data are processed by the Glasgow algorithm and different messages can be displayed/printed by the **corpuls3**.

Possible ECG diagnosis by the Glasgow algorithm

The Glasgow ECG analysis algorithm can recognize a wide range of ECG findings. These findings can be printed out as an ECG interpretation with the Glasgow Full Scale version. These are some examples:

- Frequency (defined limits for bradycardia and tachycardia)
- Various signs of myocardial infarction:
 - STEMI
 - Sgarbossa criteria
 - ST abnormalities
 - ST-T abnormalities
- PR/QT interval
- Atrial abnormalities
- QRS axis deviation
- Conduction defects like bundle branch blocks
- WPW and Brugada patterns
- Hypertrophy patterns

Critical values of ECG analysis

Complementary to ECG diagnosis the Glasgow ECG analysis identifies seven critical values. These values prompt an alarm to be displayed on the **corpuls3**.

The alarm messages are generated from different ECG findings during analysis and are only available with Glasgow Full Scale. Additionally, the alarm message appears on the ECG printout.

The following alarm messages can be generated by the Glasgow algorithm and displayed and printed by the **corpuls3**:

Alarm message	ECG findings/diagnosis
*** ACUTE STEMI *** 1	++ ST elevation or CONSIDER ACUTE INFARCT or POSSIBLE ACUTE ++ INFARCT or ++ INFARCT – POSSIBLY ACUTE
*** POSSIBLE ACUTE STEMI *** 1	++ ST elevation or CONSIDER ACUTE INFARCT or POSSIBLE ACUTE ++ INFARCT or ++ INFARCT – POSSIBLY ACUTE
*** ACUTE MI / ISCHEMIA ***	Marked ++ ST depression or CONSIDER ACUTE INFARCT or CONSIDER ACUTE INFARCT (proximal LAD occlusion) or CONSIDER ACUTE INFARCT (left main occlusion/multivessel disease) or Widespread ST depression
*** EXTREME TACHYCARDIA ***	Alarm limits adapted to the patient age: <ul style="list-style-type: none"> • 0 to 28 days: 213 -> 230/min • 29 to 180 days: 230/min • 181 days to 17 yeards: 230 -> 150/min • 18 years and older: 150/min
*** EXTREME BRADYCARDIA ***	Alarm limits adapted to the patient age: <ul style="list-style-type: none"> • 0 to 28 days: 73 -> 90/min • 29 to 365 days: 90/min • 1 to 6 years: 90 -> 45/min • 6 to 12.5 years: 45 -> 40/min • >12.5 years: 40/min

Alarm message	ECG findings/diagnosis
*** SIGNIFICANT ARRHYTHMIA ***	<ul style="list-style-type: none"> • Supraventricular tachycardia • Probable supraventricular tachycardia • Probable ventricular tachycardia • Consider ventricular flutter/fibrillation • Accelerated idioventricular rhythm • Possible idioventricular rhythm • Wide QRS tachycardia - possible supraventricular tachycardia • Wide QRS tachycardia - possible ventricular tachycardia • A-V dissociation with <ul style="list-style-type: none"> ○ paroxysmal idioventricular rhythm ○ multifocal interpolated PVCs ○ frequent multifocal PVCs ○ non-sustained ventricular tachycardia ○ 2nd degree A-V block, Mobitz I (Wenckebach) ○ 2nd degree A-V block, Mobitz II ○ complete A-V block
*** PROLONGED QTc INTERVALL ***	HF above 125/min AND QRS interval < 120 ms AND QTc interval > 520 ms

Comments regarding alarm messages:

++: The location of the infarction (e.g., anterior, inferior, anteroseptal) is added in the original message text

¹ The value limit of the ST elevation ist calculated by the algorithm based on the sex and age of the patient.

Two different parameter limits lead to different alarm messages:

- Exceedance of the *higher* limit: Acute STEMI
- Exceedance of the *upper* limit, but below the *higher* limit: *Possible* acute STEMI

The entry of age and sex of the patient at the beginning of the D-ECG interpretation is crucial for a correct diagnosis.

List of references

Translations of the messages of the Glasgow algorithm.

GS Elektromedizinische Geräte G. Stemple GmbH (2021): *Glasgow 12-lead ECG Analysis Program*, Version 1.0. Kaufering.